V02384

GS620(GS38SIN20V)
Service Manual

GOLDSTAR
COMPUTER

July 1991
Printed in Korea
P/N ; 581-712A

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Service Manual

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Specifications

Chapter 1
Introduction

The GS620 is an AT-compatible, 80386SX-based, Notebook compnter that offers the following features:

- User selectable operating speed: 10 or 20 MHz
- Floppy and hard disk drive support
- Memory expansion up to 4 megabytes
- Serial and parallel communications channels
- VGA-compatible video to the internal LCD display or an external monitor.

Figure 1-1 illustrates the computer

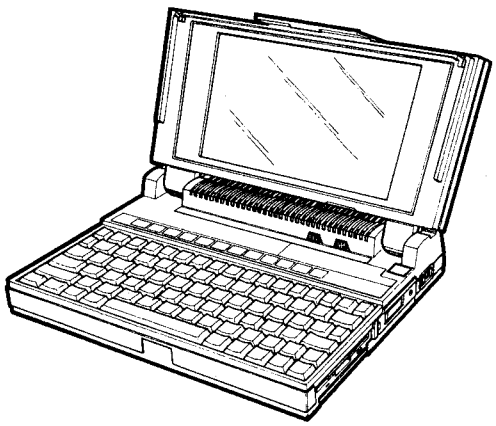


Figure 1-1 GS620 Notebook Computer

This manual includes operation, troubleshooting, and service procedures to the major assembly level.

Related Publications

In addition to this manual, the following manual may be nseful:

Operations Manual.

This manual is available from GoldStar.

Tools

Use the following tools and eqmipment to install, repair and maintain this computer.

- #1 Philips screwdriver
- PLCC IC remover
- Voltage meter

Safety Precautions

To avoid potential shock or personal injury, observe the following precautions when servicing this computer.

- Use a gronnded AC power source
- Disconnect all power before opening the cabinet
- Avoid power-gronnd shorts

Base Computer

The base computer provides all processing functions, an LCD display, disk drive options, and a keyboard. It has one serial and one parallel port for peripheral connections. The computer also supports 80-key keyboard. The computer consists of seven major assemblies:

- System board
- I/O board
- LED board
- LCD display panel
- Floppy and hard disk drives
- DC-DC power converter
- 80-key keyboard

System Board

The system board contains circuitry for processing and interface tasks in the computer. It also contains connectors for internal(LCD) and a coprocessor socket.

This board provides the following functions:

- Centural processing
- Memory control
- DMA control
- Interrupt control
- Real-time clock
- System timing
- Buffer control
- Main memory interface
- Bus/clock control
- Suspend/Resume support

I/O Board

The I/O board contains circuitry for I/O processing and interace tasks. It contains connectors for the floppy and hard disk drives, the serial port, and a parallel port.

This board provides the following functions:

- Keyboard interface
- Floppy disk interface
- Hard disk drive interface
- CRT/LCD control
- I/O port control

LED Board

The LED board contains logic for all computer's current status.

This board provides the following indications.

- POWER STATE
- SUSPEND
- HDD/FDD
- PAD LOCK
- NUM LOCK
- CAPS LOCK
- SCROLL LOCK

LCD Display

The internal LCD is a transparant negative black and white display using a eold cathode backlight to improve viewing. The display provides VGA-quality resolution of 640x480 pixels with 16 shades of gray. The display contains all driver circuits and interfaces with the system board and LED board through cables.

Disk Drivers

The computer comes with a 3.5-inch floppy disk drive capable of storing up to 1.44 megabytes of data per disk. This model come with a hard disk drive to improve storage capacity.

Power Supply

The internal DC-to-DC converter modifies the 6-11VDC input voltage to provide the following outputs:

- +5 VDC at 3.75A, 4.6A surge, ripple 50 mV p-p
- +12 VDC at 0.1A, 0.2A surge, ripple 100mV p-p
- -26 VDC at 0.04A, ripple 200mV p-p
- 1000VAC, open load
- 350 VAC, 5mA(lamp strike)

The 7.2 volt DC supply is derived from the power cube. The power cube is auto switchable, operating from 100 to 240 VAC.

Keyboard

The computer comes with an internal 80-key keyboard. The keyboard emulates the fuctions of a full-sized 101-key keyboard.

Optional Hardware

The following hardware options are avallable for this computer.

Memory - Memory expansion option:

- 2 MegaByte Module

Communication - Communication option:

- 300/1200/2400bps asynchronous Modem

Power - Battery pack and AC/DC adapter available

- Fast recharge nickel-cadmium battery pack
- AC/DC adapter

Chapter 2
Installation

This chapter provides instructions for setting up the computer, installing internal options, counecting peripherals, and making power connections.

Unpacking the Computer

Cautiou: Avoid shock hazards. Do not counect power or turn the computer on until instructed to do so.

1. Unpack the user documentation and the operating system, set them aside until they are called for.

2. Choose a sturdy work location away from heat source such as heater or radiators.

Note: Refer to the "Specifications" section for recommended operating conditions.

3. Avoid lights or windows that can cause reflections on the display or monitor.

Notice: Handle the computer with care to prevent damage. Do not drop or jar the hard disk drive.

4. Carefully unpack the computer.

5. Place the computer and any peripheral equipment on the work surface. Make certain there is unobstructed air space around the top, sides, and rear of the computer. These areas must be accessible during setup and options installation.

6. Have the customer save all shipping cartons and inserts in case they must transport the computer.

Setup

The following sections detail steps for setting up the computer for portable or desktop operation. Refer to the appropriate section for your installation.

Portable Operation Setup

If you need to install any options, do so now. Refer to "Installation of Options" later in this chapter.

Battery Seasouing

Before the customer uses the computer, he/she must "season" the battery. This allows the battery to fully charge, and equalize the charge level of eaeh cell in the battery. To season the battery, have the customer complete the following steps:

1.Refer to Figure 2-1 and install the battery pack.

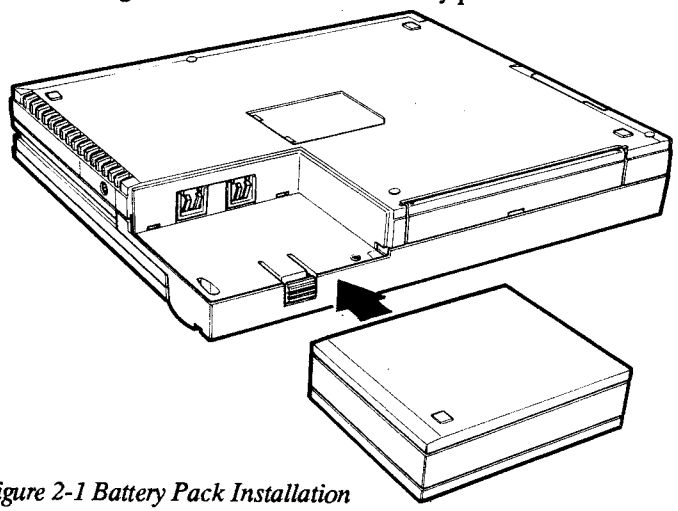


Figure 2-1 Battery Pack Installation

Notice: The computer's power cube adjust for either 110 VAC or 220 VAC operation. If you want to operate the computer from 220 VAC simply replace the power code for 220 VAC.

2. Make certain the main power switch is off. Refer to Figure 2-2 and make the power connections in the order illustrated.

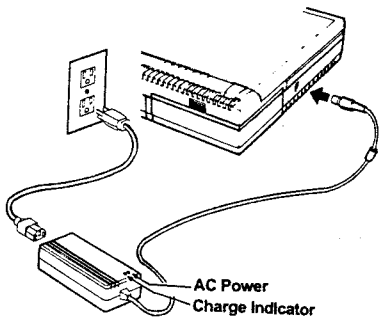


Figure 2-2 Power Connection

3. Apply power and charge the battery pack for at least ten hours.

4.Operate the computer on battery power only until the power indicator turns amber.

5.Reconnect AC power and recharge the battery pack for another three hours.

6.Repeat step 4.

Note: The AC adapter has two indicators: one indicates AC power is present, the other indicate change mode. when you charge the battery, the Charge mode indicator will be green when it is first plugged in. This indicates the battery is being quick charged. After the reaches approximately 90% of the full charge level this indicator will change color to amber. This indicates the battery is being trickle charged.

Proceed to Chapter 3 for power-up and operating instructions.

Desktop Operation Setup

If you need to install any options, do so now. Refer to "Installation of Options" later in this chapter.

Perpheral connections

1. Determine which the peripherals to connect to the computer.

2. Refer to Figure 2-3 and connect the peripheral(s).

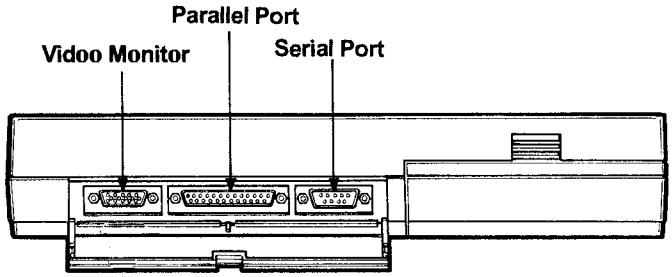


Figure 2-3 Rear Panel Peripheral Connectors

3. Make certain all cables are fastened properly and securely.

Refer to the "Specifications" section for connector pinout information.

Video

Refer to Chapter 3 for LCD display adjustments.
The computer provides an external 15-pin D-type connector for a analog monitor.

Caution: The external video output signal is a VGA, anlog RGB signal. Connecting a TTL-compatible monitor could damage the computer, the monitor, or both. Make certain the monitor is intended for VGA operation.

If you are installing an external video monitor, refer to Figure 2-4 and connect the monitor to the video connector.

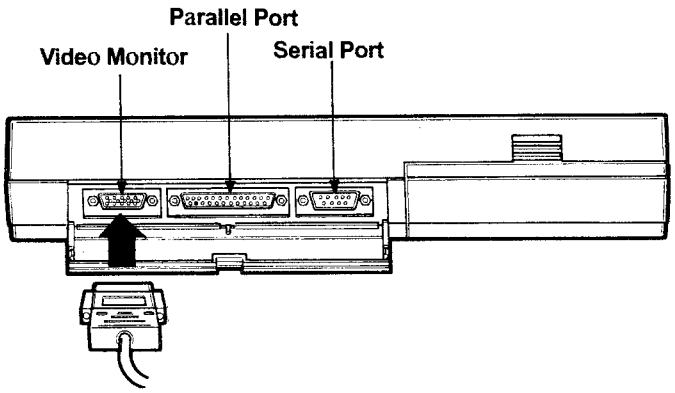


Figure 2-4 Connecting the External Monitor

Refer to the "Specifications" section for connector pinout information.

Power Connections

Before connecting AC power to the computer or any periheral, set all power switches to the OFF position.

1. Refer to Figure 2-5 and place the power switch in the OFF position.

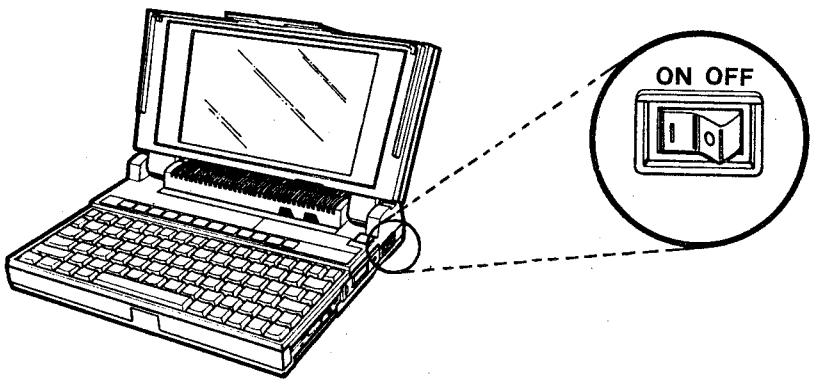


Figure 2-5 Power Switch

Notice: The computer's power cord is polarized, grounded, and shielded. GS620 model is shipped with a 110 VAC power cord. Before using a different voltge, make sure you are using the appropriate power cord.

2. Refer to Figure 2-6 and make the power connections in the order illustrated.

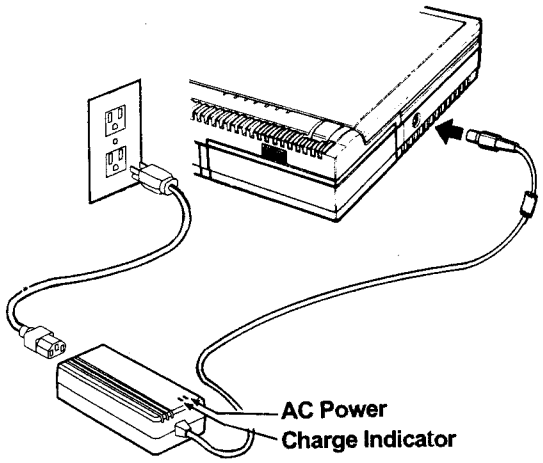


Figure 2-6 Power Conneetion

3. Attach the monitor and peripherals to the AC power source.

4. Proceed to Chapter 3 for power-up and operating instructions.

Installation of Options

The following sections describe how to install options. Refer to the appropriate section(s) and follow the steps.

Static Precautious

Use the following procedures when handling circuit boards or integrated circuits(ICs):

- Do not remove any static-sensitive device from its protective packaging until you are ready to install it.
- Equalize the static electricity between the work surface, the device, and you by touching the work surface with one hand then picking up the device with the other hand.
- Once you remove the device from its protective packaging, do not set it down or let go of it until it is either installed in the computer or returned to its protective packaging.

Nnmeric Coproeessor Installation

Cautiou: To prevent shock, discounect the computer from the AC power source before you disasseinble the coinputer.

Extreine teinperature changes and vibrations can cause the pins on the numeric coprocessor to corrode, damaging the coprocessor and the computer. Observe all safety precaution and instructions while installing the coprocessor.

1. Remove the plastic strip that has function key labels on it by liftmg up one edge with your fingernail and sliding it out.

2. Using a small, flat-bladed screwdriver, carefully reinove the internal option panel on the release tab shown in Figure 2-7

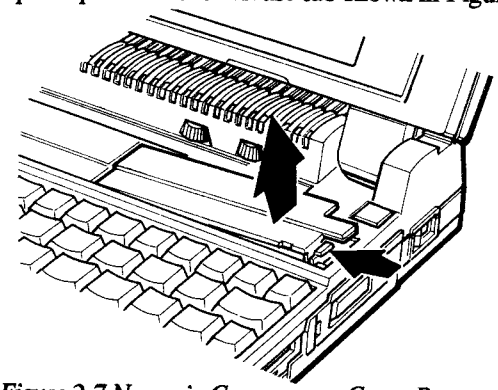


Figure 2-7 Numeric Coprocessor Cover Removal

3. Position the numeric coprocessor above its socket as shown Figure 2-8. Make sure the notched corner of the numeric coprocessor and the notched coner of its socket are lined up.

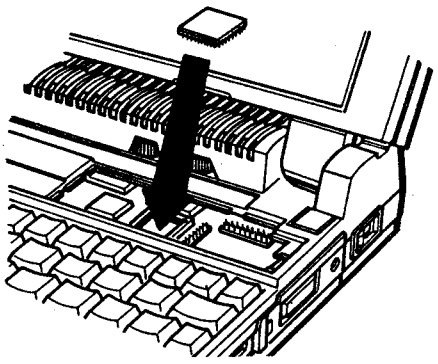


Figure 2-8 Numeric Coprocessor Installation

4. Press the numeric coprocessor into the socket.

4. Replace the access panel and the plastic strip.

Modem Installation

Caution: To prevent shock, disconnect the computer from the AC power source before you disassembly the computer.

Notice: Observe static precautions.

1. Remove and save the one screw that secure the modem cover shown in Figure 2-9.

2. Remove the modem cover.

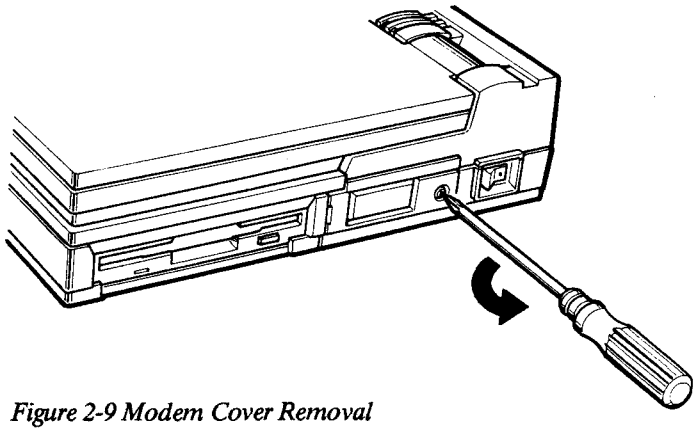


Figure 2-9 Modem Cover Removal

3. Carefully press in on blocking plug until it breaks out of the modem cover shown in Figure 2-10. Remove the blocking plug/metal shield assembly.

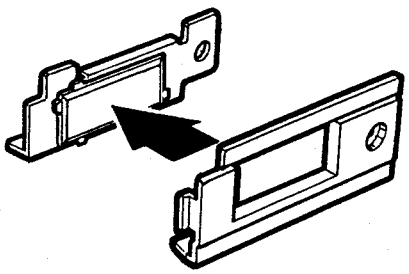


Figure 2-10 Blocking Shield Assembly Removal

4. Slide the modem into the computer and fully inserted in it's connector until it is firmly seated shown in Figure 2-11.

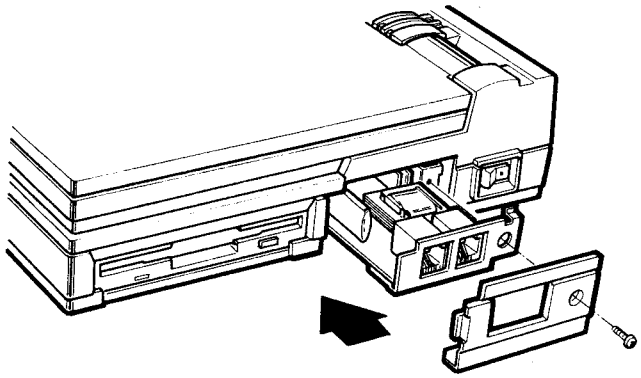


Figure2-11 Modem Installation

5. Replace the modem cover. Reinstall the screw removed earlier.

*** If the separation between the mains and the telephone network or communication system relies upon connection to the safety earth, the equipment shall have a marking stating that it must be connected to an earthed mains socket outlets.

***Apparatus connected to the telephone network:
" Apparaten skall anslutas till jordat natuttag"

***Laite on liitettava suojakosketinketmpistorasiaan"

Battery Replaeement

Caution: Danger of explosion if battary is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Discard used batteries according to manufacturer's instructions.

1. Place the computer upside down and slide the battery pack out of the computer and replace the battery pack with another one of the same type shown in Figure 2-12 .

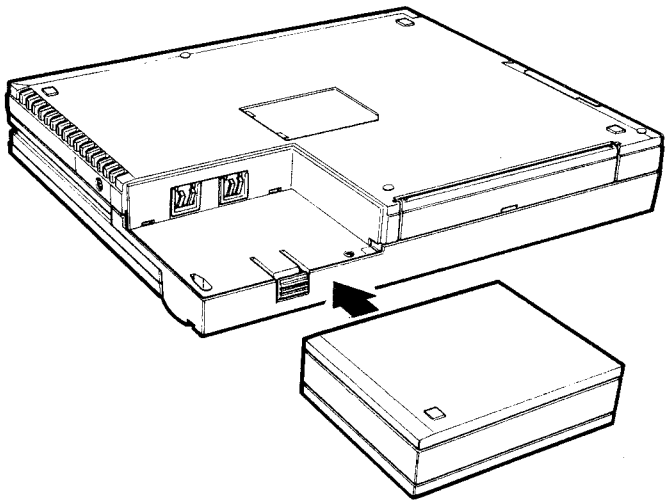


Figure 2-12 Battery Pack Replacement

2. Scason the new battery pack refer to earlier.

ROM Installation/Removal

Caution: To prevent shock, disconnect the computer from the AC power source before you disassemble the computer.

Notice: Observe static precautions.

1. Place the computer top down on a soft cloth on the work surface.

2. Remove the cover of the computer(Refer to the Chapter 5 "Disassembly the system").

3. Using an IC removal tool, or a small flat-bladed screw driver, carefully remove the ROM(s). Place them in protective anti-static foam, if possible.

4. Refer to Figure 2-13 and install the System ROM .

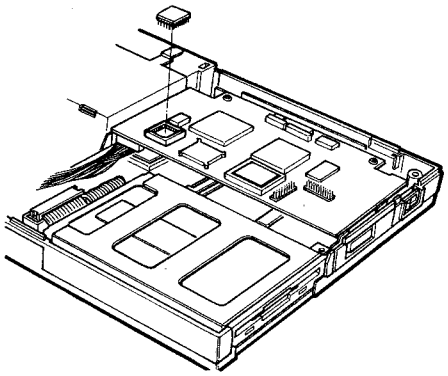


Figure 2-13 System ROM Installation

In case of installing the keyboard ROM, refer to Figure 2-14 and install it.

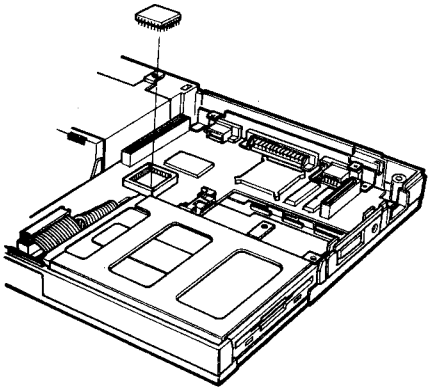


Figure 2-14 Keyboard ROM Installation

5. Replace the top cover again.

Expansion Memory Installation

Notice: Static electricity can damage the memory module(s). Use static precautions.

Cautiou: To prevent shock, disconnect the computer from the AC power source before you disassemble the computer.

1. Remove the access panel and the plastic strip shown in Figure 2-15.

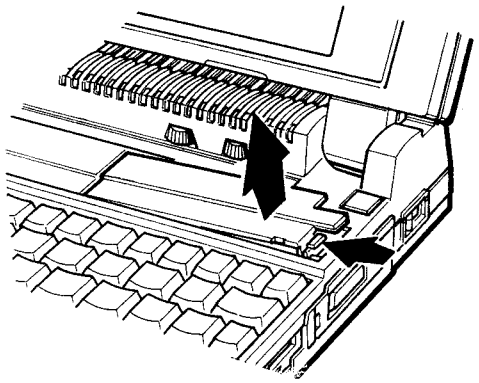


Figure 2-15 Memory Cover Removal

3. Align the memory board above it's socket . Make sure all the pins are aligned with their matching holes.

4. Refer to Figure 2-16 and install the expansion memory board. Firmly press it into the place.

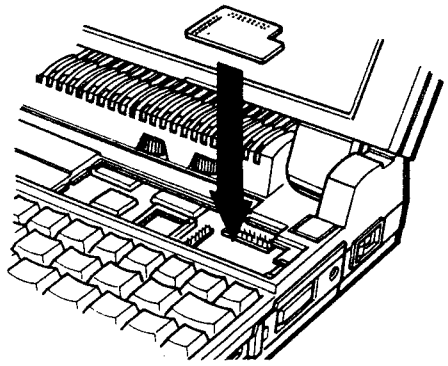


Figure 2-16 Expansion Memory Board Installation

5. Configure the additional memory as follows:

Beeause the system board contains 2 megabyte of installed RAM, the system is expandable to a total of 4 megabytes. Configure expansion memory board as shown in Figure 2-17.

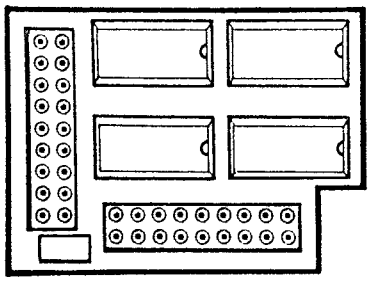


Figure 2-17 2M Expansion Memory board

6. Replace expansion memory cover(the access panel and plastic strip).

7. Run the Setup/Configuration program described in Chapter 3. Set the "Extended Memory" values so the computer recognizes the added memory.

To remove an expansion memory module, refer to Chapter 5.

Hard Disk Drive Installation

Cautiou: To prevent shock, disconnect the computer from the AC power source before you disassemble the computer.

1. Remove the keyboard as described in Chapter 5.

2. Refer to Figure 2-18 and install the drive in the computer. Be certain that the interface cable is fully seated in the connector.

3. Reinstall the keyboard, making certain the keyboard cable folds beneath the keyboard .

4. Run the Setup/Configurtion program described in Chapter3. Select the eorrect "Hard Disk Drive" type for the drive you just installed.

5. Refer to the operating system documentation for instructions on setting up the drive for use.

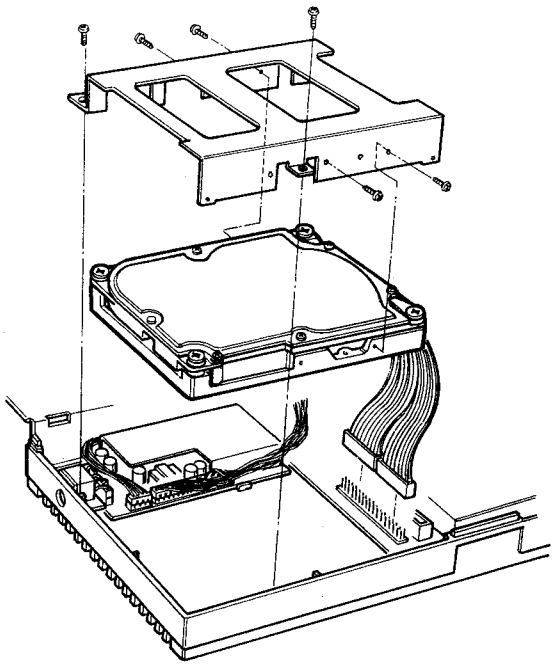


Figure 2-18 Hard Disk Drive Installation

Chapter3
Operation

This ehapter covers power up and basic operating information. Refer to the *Operations Manual for complete operating instructions.*

Power Up

Refer to F^{i} re 3-1 and turn on the computer.

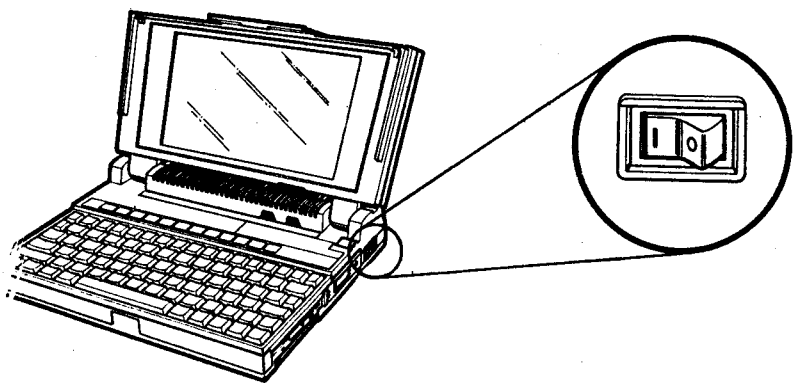


Figure 3-1 Power Switeh

When power is applied:

- The keyboard is reset (status LEDs blink)
- Main power LED blinks and remains on
- LCD panel blinks and comes on
- Hard disk drive powers up
- The keyboard resets a second time
- Floppy disk drive LED lights
- Hard disk drive LED lights
- The computer attempts to autoboot (load the operating system from the device determined by Setup)

If the operating system is not installed, or it is not present on the disk, one of the following messages appears:

Non-system disk or disk read error
Non-DOS disk error reading drive x:

These messages are normal and indicate the absence of an operating system.
If the compnter detects faults dnring the power-up sequence, error messages appear on the display (If the display is not readable, adjust the BRIGHTNESS and CONTRAST controls).

Video

Refer to Figure 3-2 and adjust the LCD display controls for the best screen image.

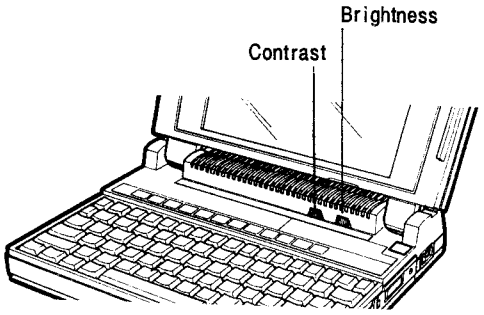


Figure 3-2 Brightness and Contrast Controls

Setup Command

The Setup/Configuration program records and stores the computer hardware configuration. This information is used each time the computer boots.

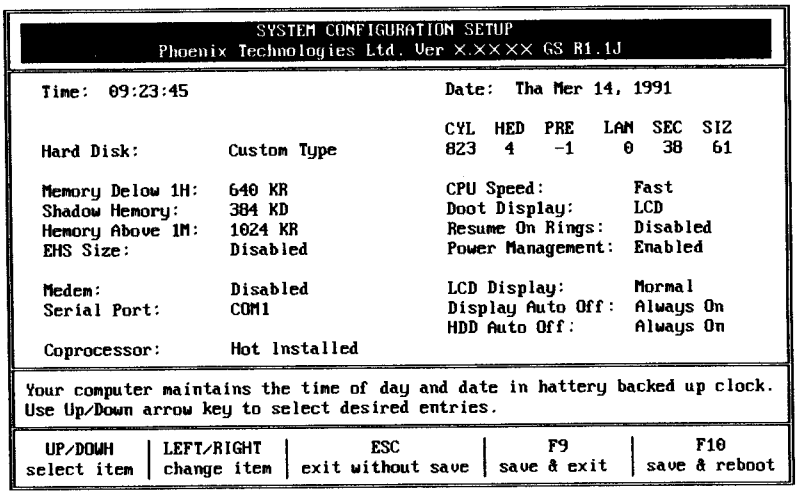

SYSTEM CONFIGURATION SETUP
Phoenix Technologies Ltd. Ver X.XXXX GS R1.1J
Time: 09:23:45
Date: Tha Mer 14, 1991
CYL HED PRE LAN SEC SIZ
Hard Disk: Custom Type
823 4 -1 0 38 61
Memory Below 1M: 640 KB
Shadow Memory: 384 KD
Memory Above 1M: 1024 KB
EMS Size: Disabled
CPU Speed: Fast
Boot Display: LCD
Resume On Rings: Disabled
Power Management: Enabled
Modem: Disabled
Serial Port: COM1
LCD Display: Normal
Display Auto Off: Always On
HDD Auto Off: Always On
Coprocessor: Hot Installed
Your computer maintains the time of day and date in battery backed up clock.
Use Up/Down arrow key to select desired entries.
UP/DOWN select item
LEFT/RIGHT change item
ESC exit without save
F9 save & exit
F10 save & reboot

Figure 3-3 Setup/Configuration Menu

There are nine optiou fields available for the display setup:

- Time Setup
- Date Setup
- Hard Disk Setup
- Memory Configuration Setup
- Serial Port Setup
- Modem Setup
- CPU Speed Setup
- Boot Display Setup
- Power Management Setup

These fields provide nnique configuration settings for each operating mode. To change the Setup menu, press the Down and Up arrow keys. Use the Right and Left arrow key to move from field to field.

Time		Standard 24-hour format HHMMSS. To set the time , use the arrow keys.
Date		Standard month/day/year format. To set the date, use the arrow keys.
Hard Disk		Change this option only if the original drive is replaced with a different one. Select the correct drive type from the available options.
Serial Port		Set the serial port to be CoM1(3F8H) or COM2 (2F8H) when optional modem is installed. When not installed, it is fixed COM1.
Modem Port		This field can only be changed if the optional modem is installed. When the internal modem is installed, it will be set to COM1(3F8H) or COM2(2F8H)
Coprocessor		When Coprocessor is installed, it detected automatically.
Memory	**Base**	Base memory is user memory located in the first megabyte of memory. This option sets the size: 640MB.
	Extended	Extended memory is typically used by "virtual disk" programs and some application software. Size is limited to available memory above one megabyte.
	EMS	EMS memory refers to memory meeting version 4.0 of the Lotus/Intel Memory Specifications. EMS memory requires a driver program for proper operation. Size is limited to available memory above one megabyte. Refer to "Memory Allocation" later in this chapter.
		Note: Extended and EMS memory share memory space above oue megabyte. The total of both types cannot exceed t the total installed memory minus the Base memory.

CPU speed	**Fast**	Maximizes speed to 20MHz for best performance.
	Slow	Saves battery power by reducing clock speed to 10 MHz for software compatibility.
Boot Display	**LCD**	Selects the default LCD presentation when booting.
	CRT	Enables the external VGA video port when booting with the monitor attached to the computer.
Power Management	**Disabled**	Enables the reverse video option. Display Auto-off and HDD Auto-off options.
	Enabled	In this case, power parts are controlled by the POP-UP program.
Exiting Program		When you finish making entries, press F10 to save the changes and to restart the computer. To save the changes into the CMOS RAM and continues the job without being disturbed by the changes, press F9.

POP-UP Program

This is similar to the Setup program. It allows you to customize certain operating parameters.

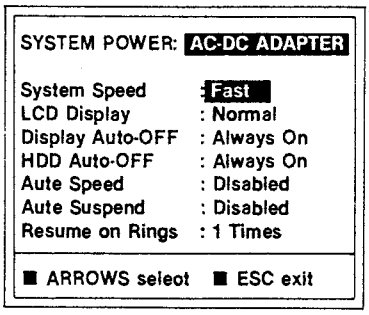

SYSTEM POWER: AC-DC ADAPTER
System Speed : Fast
LCD Display : Normal
Display Auto-OFF : Always On
HDD Auto-OFF : Always On
Aute Speed : Disabled
Aute Suspend : Disabled
Resume on Rings : 1 Times
■ ARROWS seleot ■ ESC exit

Figure 3-4 Popup Menu

There are seven option fields available for display setup:

- System Speed
- LCD Display
- LCD Auto-Off
- HDD Auto-Off
- Auto Speed
- Auto Suspend
- Resume on Rings

To set the Popup features use the up and down arrow keys to move from field to field and the right and left arrow keys to change the field.

System Speed

This field allow you to change the operating speed. The speed that you setin this field is temporary. It will only be in effect until you turn off the computer.

Fast — Maximizes speed to 20 MHz.

Slow — Reducing clock speed to 10 MHz.

LCD Display

Normal — Black on white backgroumd. Text is most easily viewed in this mode.

Reverse — White on black backgroumd. Graphics displays may look better in this mode.

LCD Auto-Off

Set the LCD screen to turn off after a certain amount of time has elaped without a key being pressed. The screen will turn back on as soon as you press a key or move the mouse. This feature helps conserve battery power.

HDD Auto-Off

Set the hard disk drive to turn off after a cretain amount of time has elapsed without a hard disk acess for conserving battery power.

Auto Speed

Automatically slow internal clock 2 MHz after two minutes have elapsed without key being pressed. When any key pressed, computer will automatically return to normal speed.

Auto Suspend

Set the computer to go into the suspend mode after a specific amount of time has elapsed without key being pressed. To resume, press the suspend button above the keyboard.

Resume on Rings

Set the computer to resume from suspend mode after a certain number of rings on the telephone line. You must have the optional modem installed to use this feature.

Exitiug Popup

To exit Popup, press the ESC key.

Memory Alloeation

When assigning memory for use in the computer, keep the following in mind:

- MS-DOS applications usually include the operating system when they specify a minimum memory requirement.
- MS-DOS applications specifying a minimum memory requirement of 512KB or less run more efficiently with the maximum base memory-640KB.
- The MS-DOS operating system can use extended memory for "virtual disk" applications. If you set up a "virtual disk," make certain sufficient memory is allocated.
- Some MS-DOS applications use extended memory independently of the operating system. These applications typically require maximum base memory - 640KB.
- Some application programs that use EMS memory do not specify a minimum memory requirement. Review the application documentation for required memory sizes.

Disk Drives

This computer supports one internal 3.5-inch, 1.44MB floppy disk drive and one 2.5-inch hard disk drive.

Keyboard

The computer comes with an enhanced 80-key keyboard. The keyboard, illustrated in Figure 3-4, features anto-repeat, and software programmability.

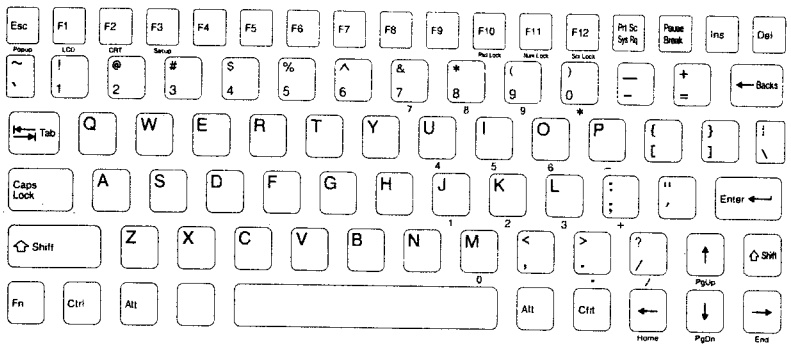


Figure 3-4 Notebook Keyboard

Chapter 4
Functional Theory

This chapter explains the operation of major circuits in the computer.

Architecture

The GS620 is an AT-compatible Notebook computer based on the 80386SX mieroprocessor. The computer provides VGA video suppport, one parallel and one serial communication channel, and niodem support. Figure 4-1 is a diagram of computer, illustratmg the major functional blocks and busses.

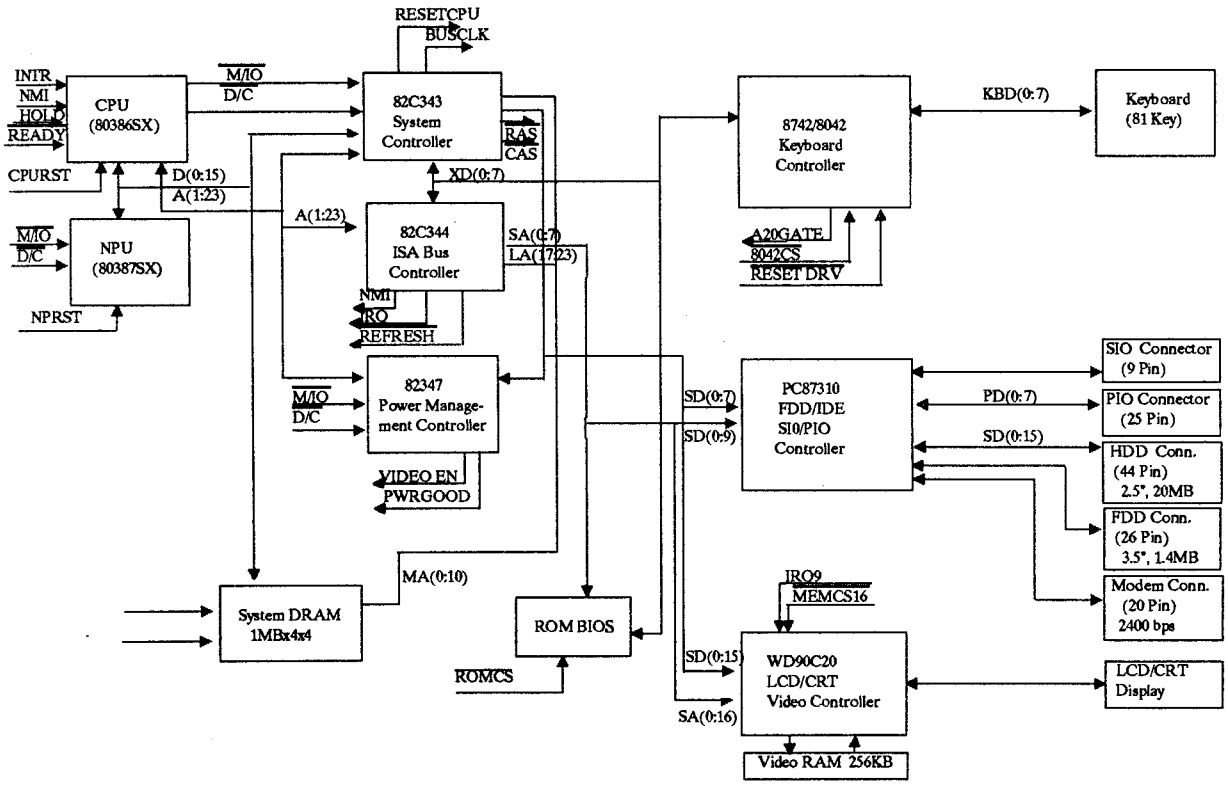


Figure 4-1 Functional Block Diagram

System Circuitry

These circuits initialize the computer system, process DATA, control read and write operations, control memory or I/O selection, and system shutdown. This section consists of the CPU, numeric coprocessor (optional), CPU/bus controller, the address/data buffer, ISA bus controller and the power management controller.

CPU - The 80386SX executes program instructions, processes data, interrupt requests, and sends control codes to the rest of the system. These codes identify different execution cycles including:

- Interrupt acknowledge
- Memory read
- Memory write
- Memory instruction read
- I/O read
- I/O write

The CPU operates at 10 or 20 MHz, providing near zero wait state performance. The CPU uses a 24-bit external address bus and a 16-bit data bus.

NPU - The optional 80387SX numeric coprocessor performs dedicated math operations that would slow down the CPU. The coprocessor expands the CPU's capabilities by adding additional instructions and hardware registers. The coprocessor interfaces directly with the CPU over the 16-bit processor data bus.

System Controller - The 82C343 contaius the system control and data buffering functions in a 160-lead quad flat pack. The 82C343's functions are highly programmable via a set of internal configuration registers. Defaults on reset for the configuration registers allow the system to boot at the CPU's rated speed. However, operational capability may be temporarily reduced until the configuration register are set to mirror the true system configuration. This nomally is a function of BIOS setup. The system controller handles system board refresh direetly and also controls the timing of slot bus refresh which is acturally performed by the 82C344 I8A bus controller. Refresh may be performed in coupled mode. This may be programed for independent, slower than nomal rates. In sleep mode, -CA8 before -RAS refresh may be switched for maximum power saving.

EEMS support is provided in hardware for complete LIM-EMS 4.0 standard. Shadowing features are supported ou all 16K boundaries between 640K and 1M. Simultaneous EMS use, shadowed ROM and direct system board access is possible in non-over lapping fashion throughout this memory space.

Control options:
1. Access ROM for read and write.
2. Access system board DRAM for read and write.
3. Shadow setup mode, Read ROM, write system board DRAM.

This controls are overriden by EMS in segmeuts for which it is enabled.

The 82C343 is used to program the desired operational mode of AT bus. Based on this programming, it provides the bus clock and signalling interface to the BUS controller. The bus clock may be derived from the CLK2 or bus OSC input. a programmable divider conditious the selected BUS clk source providing divide by 1, 2, 3, or 4.

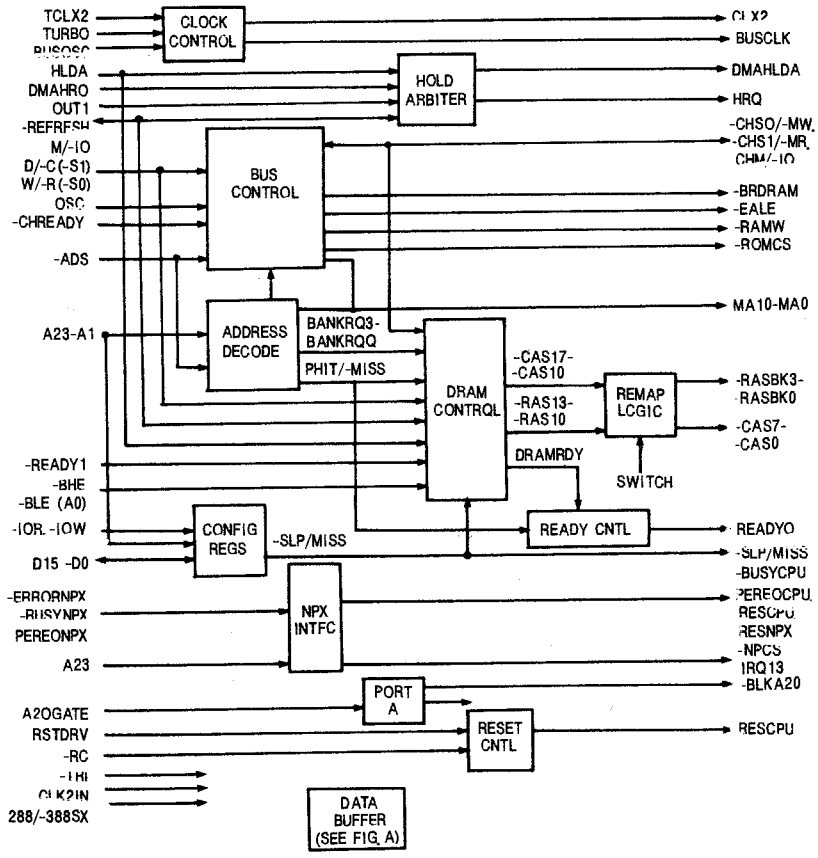


Figure 4-2 System Controller Block Diagram

Data Buffer - The 82C343 also performs all of the data buffering function required for a 386sx-based PC/AT compatible system. Under the control of the CPU, the data buffer chip routes data to and from the CPU's D bns, XD bus and SD bus. The 82C343 provides the data conversion necessary for 16 bit accesses to 8 bit devices on the XD or SD buses. The data is latched for syncronization with the CPU.

Under the control of DMA or a bus master, the 82C343 allows 8 or 16 bit data to be routed to and from the XD. The chip also is capable of performing high to low and low to high bytes swaps on the SD bus. The chip also provides the feature of a single input, -TRI, to disable all of its ontputs for board level testability.

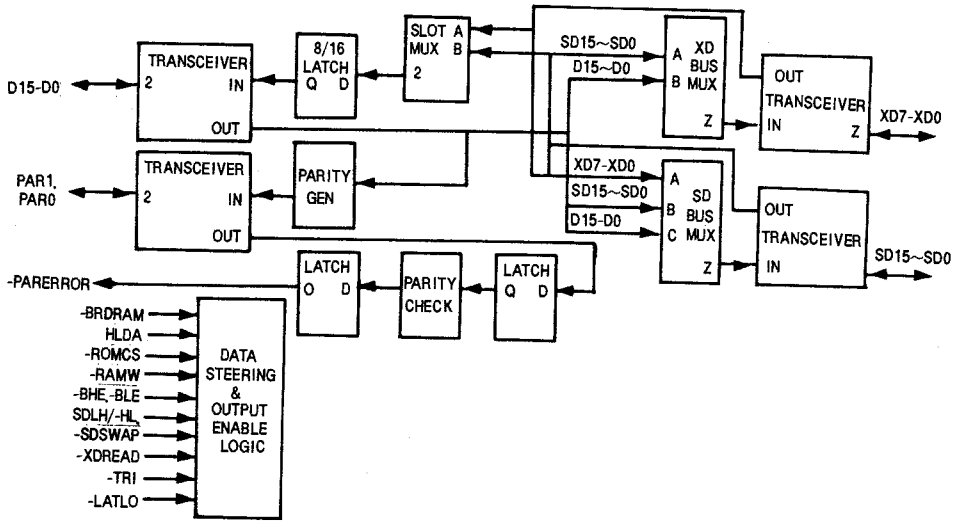


Figure 4-3 Data Buffer Blockdiagram

ISA Bus Coutroller - The 82C344 ISA Controller provides the functions of DMA page address register, timer, interrupt control, Port B logic, and real time clock. The 82C344 directly drives the refresh addresses. Built-in sleep mode featurcs work together with System controller sleep features to provide a low power system idle state for extension of battery life in computer. The upgraded DMA channels provide a superset of AT functionalilty by allowing DMA to the entire 64MB memory range of the 82C344 chip set.

Additional functionlity is provided via DMA wait state, clock and MEMR timing programmablity.

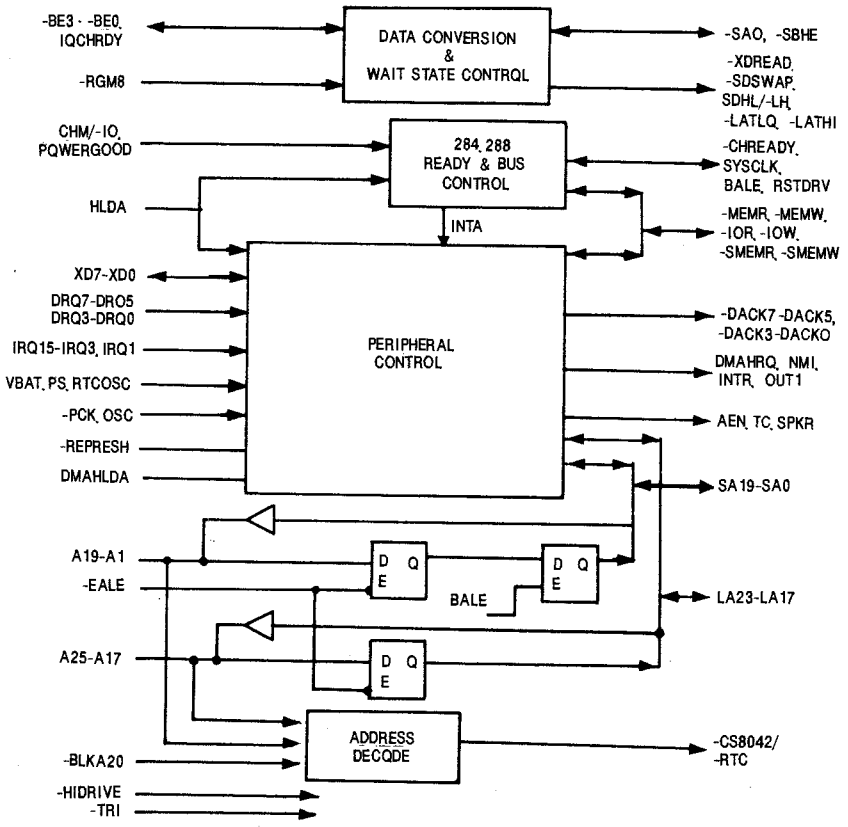


Figure 4-4 Bus Controller Blockdiagram

Power Management Controller - Peatures;

- Supports multiple power savings modes
- Multiple Independent device power shutdown support
- CPU and peripheral clock control
- Independent programmable timeouts for all modes
- Power on control via pushbutton, RTC clock alarm or Modem Ring-in
- Power UP/DOWN Power Sequencing for LCD Panel
- Multiple Low Battery Monitoring
- Refresh support for nomal and slow reflesh D-RAM during SUSPEND mode.

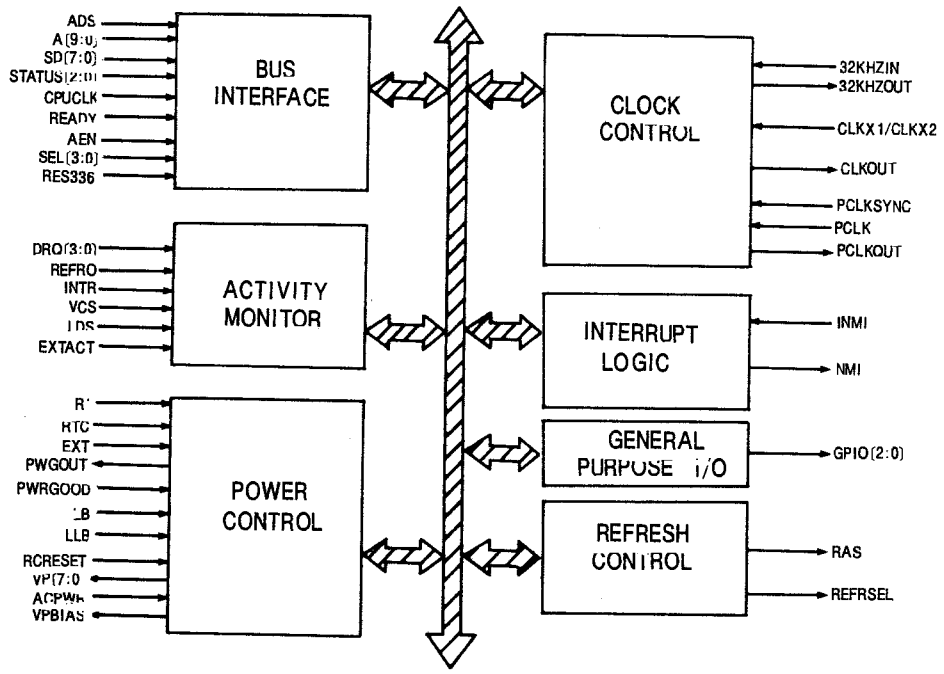


Figure 4-5 82347 Blockdiagram

I/O Circuitry

These circuits support SIO/PIO, FDD/HDD, keyboard and video graphics array. This section consists of super I/O, viseo and keyboard controller.

PC87310 Dual UART with Floppy Disk Coutroller - The PC87310 incorporates two full function UARTs, a floppy disk controller with analog data separator, one parallel port, hard disk controller decode, standard address decording for on chip function, and a configuration Register in one chip.

The floppy disk controller is fully compatible with the industry standard 765 architecture, and it includes many more advanced options such as a high performance data separator.

The parallel port, hard disk select, matain complete compatibility with the IBM XT, AT. Hardware selects XT or AT compatibility.

The configuration Register is one byte wide and can be programmed via hardware and software. Through its control the user can assign standard AT addresses and disable any major on chip function independently of the others. This allows for flexibility in system configuration when adapter cards contain duplicate functions.

Features;

- 100% compatible to the IBM PC. XT and AT
- On chip analog data separator operates up to 1MB/s
- Decoding and chip selects for a hard disk interface
- Low power CMOS with a power down mode
- Precision analog data separator
- Separate interrupt request lines for the parallel and serial port
- Indepentently controlled transmit, receive, line status and data set interrupts.
- Progammable baud generators for each UART channel
- MODEM control functions for each UART channel
- Fully programmable serial interface characteristics

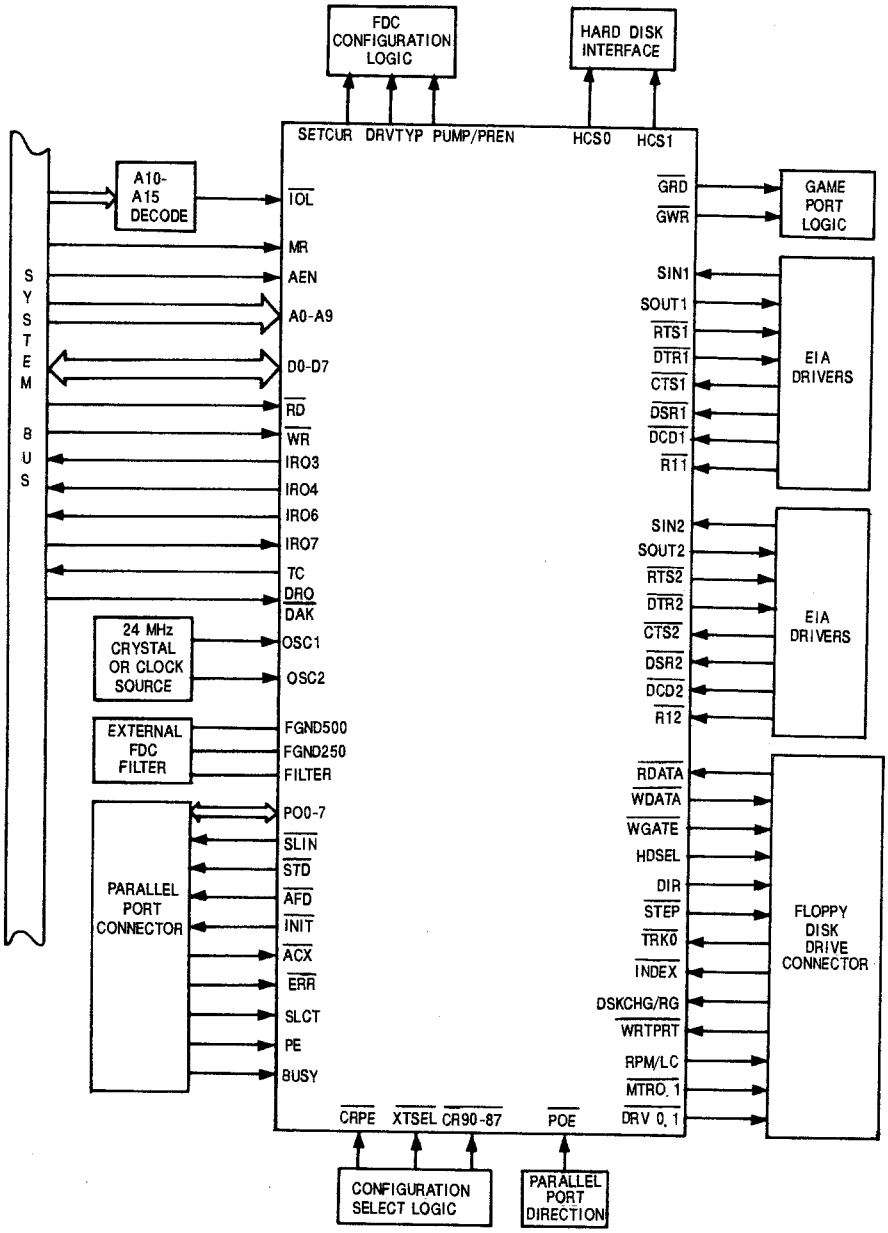


Figure 4-6 87310 Basie Configuration

Video - The video circuitry of the graphics controller, video memory, the color palette, the LCD display, and the external CRT interface. The video hardware supports the default internal VGA LCD display, or an external analog monitor. These circuits can also emulate EGA,CGA, MDA, and Hercules-compatible video display modes. Figure 4-5 provides a block diagram for the video circuitry.

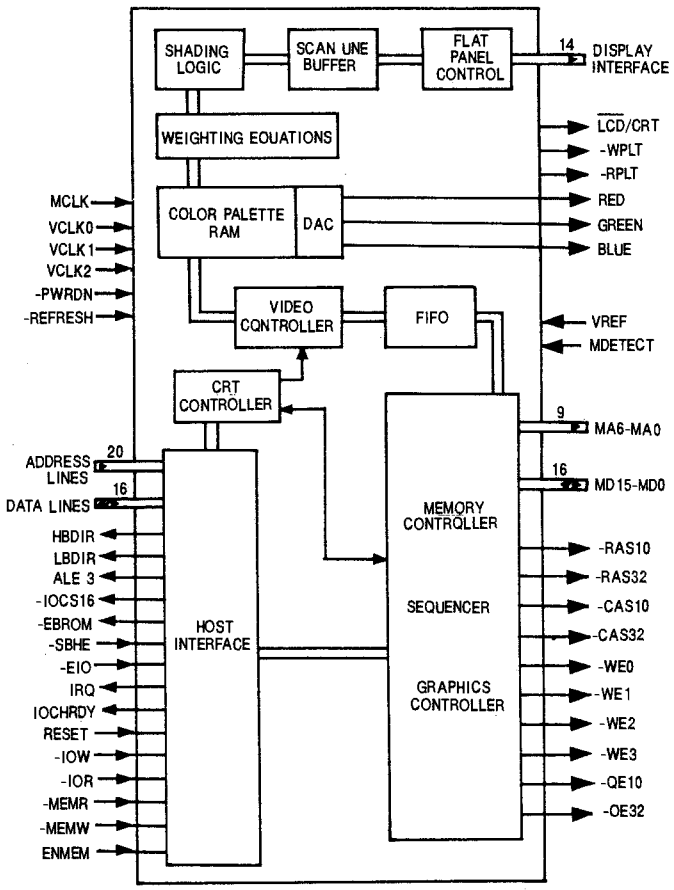


Figure 4-5. Video Circuitry Block Diagram

Graphics Controller - The graphics controller provides most of the control circuitry for the video subsystem, including:

- Video memory control
- Color palette control
- Vertical and hotizontal sync signals
- Dot clock and blanking signals.

Video Memory - Video memory consists of 256 kilobytes of dynamic RAM. Video memory is accessed and controlled by the graphics controller. The controller provides two address and four data busses to video memory.

Color Palette - The color palette (or color look-up table) provides the graphics controller with a selection of 256,000 possible colors for external CRT display purposes. This device also drives external CRT with the necessary video signals.

LCD Display - The internal LCD display is used to dispplay video images to the user, and is driven by the graphics controller through a buffer. The display can generate 16 levels of gray.

External CRT Interface - The interface between the computer and the external CRT (optional) cousists of the color palette, a buffer, and the CRT connector. This interface supports analog VGA video.

Power Supply

Warning: Do not attempt to service the power supply. High energy level hazards are present even when disconnected.

The internal DC-to-DC converter converts the 6-11VDC input to the following supply voltages:

- +5VDC, 3.75A, 4.6A surge, ripple 50mV p-p
- +12 VDC, 0.1A , 0.2A surge, ripple 100mV p-p
- -26VDC, 0.04A, ripple 200mV p-p
- 1000VAC ,open load
- 350VAC, 5mA(lamp strike)

The converter provides sufficient power to operate the computer during battery charging.

Bus Description

The following sections introduce the major busses used on the main board of the computer. The busses include address, data, and control signals.

Proccssor Bus

The processor bus provides the communications and control paths between the CPU and it's support circuits.

Address Bus - The bidirectional bus consistsof lines A1 - A23. The bus connects the CPU to the system controller, ISA bus controller and power management controller.

Data Bus - The bidirectional data bus consists of lines D0 - D15. The data bus connects the CPU to the numeric coprocessor and the system controller and memory data bus.

Control - The local bus control signals control direction of data flow between the local address bus and extended address bus, and between the local data bus and memory data bus. The control signals report the status of activities on the local bus. The signals consist of:

. M/IO (memory or I/O cycle)
. W/R (write/read cycle)
. HOLDA (hold acknowledge)
. BUSYNPX (coprocessor busy)
. RESETCPU (CPU reset)
. NMI (non-maskable interrupt)
. HRQCPU (CPU hold requcst)
. CLK2 (6/12 MHz clock)
. D/C (data/code)
. ADS (address strobe)
. BHE (byte high enable)
. ERRORNPX (coprocessot error)
. RESETNPX (coprocessor reset)
. INTR (maskable interrupt)
. READYSYS (CPU cycle complete)
. BLE(address latch enable)

System Bus

The system bus provides the communications path between the major peripheral devices and the central control circuitry in the computer.

Address Bus - The bi-directional bus connects the ISA bus controller with UART and video controller. This bus consists of SA0-SA17.

Data Bus - The bi-dircctional bus consists of lines SD0 - SD15. It connects to the system controller, UART and PMU, transceivers on the video bus. It also provides data for the hard disk connectors.

Extended Data Bus - The bi-directional bus consists of lines XD0-XD7. It connects to system controller, ISA bus controller, system ROM and keyboard controller.

Control - These signals report activitis on the bus, and control data direction between the system bus and other busses. The control signals consist of:

. BE0(byte enable 0)
. BE1(byte enable 1)
. BE3(byte enable 3)
. EALE(early address latch enable)
. BALE(buffered add. latch en.)
. MEMCS16(memory chip select 16 bit)
. SDSWAP(system data swap)
. SDLH/HL(system data low to high/)
. RSTDRV(reset drive)
. I/O W/R (I/O write/read)
. MEM W/R(memory write/read)
. CHREADY(channel ready)
. IRQX(interrupt request)
. DRQX(DMA request)
. HRQ(hold request)

Memory Bus

The memory bus provides the communications channels betwwen memory and system controller.

Address Bus -The bi-directional address bus consists of lines MA0-MA7. It connects the system controller to memory.

Data Bns - The bi-directional data bus consists of signal MD0- MD15. It connects the system controller to memory.

Control -The memory bus signal cousists of:

. M/IO(mcmory /I/O enable)
. RAS(row address strobe)
. CAS(column address strobe)
. REFRESH(refresh signal)
. MEMW(memory write)
. MEMR(memory read)

Video Bus

The video bus connects the video controller to the output display devices.

Address Bus - The bi -directional address bus cousists of lines VMA0 - VMA7. The Bus connects the video controller to the video memory.

Data Bus - The data bus is not bi-directional. It consists of lines VMD0 - VMD15. The bus connects the video controller to the video memory.

Control - the following control signals are used on the video bus.

. VRESETDRV(reset signal)
. VAEN(enable I/O)
. VREFRESH (video refresh)
. VPWRDOWN(video power down)
. VCASX(column address strobe)
. VRASX(row address strobe)
. VWEX(write enable)
. VRED(red current output)
. VGREEN(green current output)
. VBLUE(blue current output)
. LP(latch pulse)
. FP(frame pulse)
. FR(framc control)
. XSCLK(shift clock)
. LCD/CRT(LCD or CRT select)

Reset

The computer's reset circuitry returns the computer to a known state to start operation. Two methods are available: a hardware (hard) reset or a software (soft) reset.

Hardware Reset

A hardware reset completely resets the computer. It initializes major circuit groups and starts operation from a known condition. This happens whenever the computer is turned on or when it recovers from a power failure.

When power is applied to the computer, a single-shot circuit on the power management controller generates the SYSTEMPOK and RCRESET pulse. This signal is fed to the ISA bus controller which latches the signal to provide an internal reset. The controller then generates RESETDRV. RESET CPU resets the CPU, while RESETNPX resets the coprocessor, if one is installed. RESETDRV provides a reset pulse to the following devices:

- System controller
- Floppy disk controller
- Keyboard controller
- Video controller.
- Hard disk controller

Software Reset

A software reset only resets the CPU; all other circuits and memory are unaffected. The CTRL-ALT-DEL or CTRL-ALT-INS key combinations start this process.

When the ISA bus controller receives one of the reset key combinations, it generates RESETDRV. The RESETDRV signal goes to the system controller which generates RESETCPU, resetting the CPU.

Bus Arbitration

Bus arbitration is the orderly management of interual and external busses, granting essential system elements access to the system bus without disrupting normal operatious. Arbitration allows one bus master to control the bus at any given time. All other masters tri-state, or float, their outputs to prevent bus contentions. The following sections briefly discuss bus arbitration under typical operating eonditions.

Bus Masters - A bus master is any device that takes physical control of the bus. The master uses I/O read and write or memory read and write signals to transfer data over the system bus. Bus masters in this computer include the CPU circuitry (CPU and the system controller), and the DMA controller.

CPU - The CPU works with the system bus controller to provide bus arbitration logic. This differs from earlier PC machines where the CPU only used hold and hold acknowledge to control the bus. These two devices control I/O and memory read and write operations.

DMA - DMA control provides a faster method of data transfer than a normal I/O read or write cycle. The DMA controller supports three different transfer operations:

- I/O to memory
- Memory to I/O
- Memory to memory.

In this computer the floppy disk controller and the external bus use the DMA circuits.

To obtain DMA service, the requesting device asserts it's assigned DMA request (DRQ) line. The DMA controller (located in the IBC) receives the request and sends a hold request (HRQ) to the system controller. The system controller issues hold request (HOLD) to the CPU. The CPU completes the current cycle, then asserts hold acknowledge (HLDA). The system controller receives HOLDA and sends HLDA to the IBC. The IBC receives HLDA and returns a DMA acknowledge (DACK) signal to the requesting device. (This lets the requesting device know it has access to the bus.) When the DMA cycle is complete, the IBC releases HRQ. HLDA is then released, returning bus control to the CPU circuitry.

Note: DMA cycles can last no longer than 15 microseconds. Exceeding this time period can cause contention with refresh cycles.

Refresh - A refresh cycle begins every 15 microseconds when the IPC issues a refresh request. The system controller asserts the CPU hold request line (HOLD) and once acknowledged, memory refresh logic within the system controller has control of the bus. The refresh address is provided on address lines MA0-MA9.

Memory Cycles

A memory cycle involves reading from or writing to a memory device. The following sections describe the various cycles involved in this process.

ROM Read

The CPU begins the ROM read cycle by placing address information on the processor bus and asserting the control lines. The control signals are decoded by the system controller which controls the address/data buffer. It then asserts ROMCS, enabling the ROM output control. ROM data is then placed on the memory data bus.

A ROM read occurs when the computer is first powered up, during ROM BIOS calls, or during the execution of ROM test programs. When the computer is first powered up, the CPU automatically performs a read from reserved address FFFFF0H.

Memory Read

The CPU starts the memory read cycle by placing address information on the processor bus. The CPU then asserts the control lines as shown in Table 4-1.

M/IO	D/C	W/R	Cycle Type
0	0	0	Interrupt acknowledge
0	0	1	Invalid
0	1	0	I/O data read
0	1	1	I/O data write
1	0	0	Memory code read
1	0	1	Shutdown/Halt
1	1	0	Memory data read
1	1	1	Memory data write

Table 4-1. CPU Cycle control Signal Decoding

Thc system controller decodes the control signals, then generates the RAS and CAS signals. It also generates the memory address (MA0 -MA10) for the cycle. Data read from memory is placed on the process data. Upon completion of a memory read cycle the system controller generates READY, informing the CPU circuitry the cycle is complete.

Memory Write

A memory write cycle is very similar to a memory read cycle. The cycle starts when the CPU asserts M/IO high, and places the memory address on the processor bus. The remaining control signals indicate a memory write operation is in progress.

The system controller decodes the control signals, then generates RAS and CAS, the memory address(MA0-MA9). Upon completion of a memory write cycle, the system controller generates READY, informing the CPU circuitry the cycle is complete.

Refresh

Once every 15 microseconds the IBC issues OUT1 to the system controller. The controller responds by issuing a hold request (HOLD) to the CPU. Once acknowledged by HLDA, the refresh address is placed on the processor address bus. The system controller then asserts REFRESH initiating a memory refresh cycle. The memory/page controller uses this information to generate the memory refresh address(MA0 -MA9), the RAS control signals. One memory read cycle is performed during a memory refresh operation.

When the refresh is complete, REFRESH goes inactive and the HOLD line is released. This returns bus control to the CPU circuitry.

DMA Cycles

DMA operations allow large blocks of data to move quickly between memory and peripheral devices. The design of this computer permits DMA operations anywhere within the 8-megabyte memory address space. The computer supports both 8-and 16-bit DMA transfers. Refer to "Bus Arbitration" earlier in this chapter for a discussion of DMA controller bus access. The DMA controller operates in the following modes:

Idle - In this mode, the controller samples the DREQ inputs every clock cycle. The internal select signal and HLDA are also sampled to determine if the CPU circuitry requires access to the internal registers.If either signal goes active, the DMA exits idle mode.

Program - The program mode allows reading or writing the internal DMA registers. This occurs whenever HLDA is inactive and the internal select signal is asserted.

Active - The controller enters the active mode whenever a software or DMA reqnest occurs and the device is not in the program mode.

I/O Cyeles

I/O cycles allow the computer to communicate with the modem, external hard disk drive, and other I/O devices. An I/O cycle consists of a read or write operation.

I/O Read

The CPU initiates an I/O read cycle by placing the address on the processor address bus and asserting M/IO low. The CPU status lines encode the cycle. The system controller decodes these signals and generates CHS0/MW,CHS1/MR and CHM/IO signals to the IBC. The IBC generates IOR signal to the I/O devices. I/O data is either transferred to memory or processed by the CPU. The CPU/bus controller issues READY upon completion of the cycle.

I/O Write

An I/O write cycle is similar to an I/O read cycle except the CPU/bus controller issues XIOW. Data transfer is from the system to the I/O device. READY is asserted by the CPU/bus controller, indicating the cycle is complete.

Interrupt Cyeles

An interrupt cycle occurs whenever a device activates one of the interrupt request lines (IRQ), requesting the CPU to suspend current program execution and perform an interrupt service routine. The CPU responds by encoding interrupt acknowledge on it's status lines. The system controller decodes the status lines and issues interrupt acknowledge CHS/MW,CHS1/MR,CHM/IO for two clock cycles. The IBC determines the priority of the requesting device during the first clock cycle. During the second cycle,the IPC outputs an 8-bit vector on the XD bus. The CPU reads the latched vector and executes the service routine.

Interrupt request lines are monitored and prioritized by the interrupt controller within the IPC. The starting addresses for all interrupt service routines are stored in an interrupt vector table located in the first 1K of system memory (memory address 000000H-0003FFH).

Halt and Shutdown

The CPU enters a halt state after executing a software halt instruction. The CPU indicates this condition to the system controller, then enters an idle state. The system completes the current operation, then also becomes idle. Once halted, the CPU can resume operation only if reset, or if an interrupt request occurs or non-maskable interrupt request occurs.

The CPU shuts down if it encounters a processor double fault condition. This occurs if the CPU attempts to access an invalid memory location. Once shut down, the CPU can resume operation only if reset, or if a non-maskable interrupt request occurs.

I/O Operation

I/O operations consists of the real-time colck, programmable interval timer, serial and parallel ports, video, and floppy disk drive.These are explained in the following sections.

Real-Time Clock(RTC)

The real-time clock (RTC) is part of the IBC. It contains 114 bytes of RAM used to store time and date information, along with setup information used by the computer. If power fails or is turned off, the RTC is backed-up by battery. The timing source for the RTC is a 32.768 kHz crystal oscillator. This signal is divided internally by the RTC for clock timing.

The computer accesses the RTC by placing an address on the system address bus. When the IBC EALE line goes low, the IBC decodes system address to determine which subsystem the computer wants to access. The computer then places data on the XD bus, bits XD0-XD6. The IBC then uses the data on the bus as an index pointer to the desired location in the RTC.

If Vcc falls below 4.25 VDC, the PP (POWER FAIL) outpnt on the backup battery source goes active. If Vcc falls below 3.0 VDC, the battery source switchs on and supplies power to the RTC.

Programmable Interval Timer(PIT)

The PIT section of the IPC contains three separate 16-bit timers. Timer 0 is the system timer (IRQ0), timer 1 is for memory refresh OUT1 and timer 2 controls tone generation for the speaker.

The times are accdessed by placing an address on CPU address bus . When EALE goes low, the IBC decodes the address determining which timer is being accessed. IOR and LOW control read and write operations on the PIT. At power up, each timer is programmed with a control word to start operations.

Serial Port

Onc RS-232 serial communicatious port is provided in this computer. Communications control is provided by the asynchronous communications part(ACP) within the Dual UART with floppy disk controller.

Timing for the ACP is provided by an internal 1.8432 megahertz clock which is divided by an external 24 megahertz crystal oscillator. This clock signal is divided internally to develop various baud rates used during serial communication.

The ACP receives serial data from the RS-232 device over the RxD line. This data is converted to parallel format and placed on the SD0-SD7 lincs. Data transmitted to the RS-232 device is received from the SD bus, converted to serial form, and transmitted on the TxD line. The serial communicatious channel is addressed over the system bus. IOR and IOW control read and write operations involving serial port data.The following stauts signals are used with the serial port:

- DCD - Data carrier detect
- DTR - Data terminal ready
- DSR - Data set ready
- RTS - Request to send
- CTS - Clear to send
- RI - Ring indicator

Parallel Port

One Centronics-compatible parallel port is also supported by the multifunction contrller.

The Dual UART with floppy disk controller interfaces the parallel port bns (PD0- PD7) with the system bus. The parallel communications channel is addressed over the system bus. IOR and IOW control read and write operations involving parallel port data. The following signals are used with the parallel port:

- STROBE - Data strobe
- PACK - Data received acknowledge
- BUSY - Device busy, unable to receive data
- PE - Paper end / fault indicator
- SLCT - Select status / ready for another character
- AUTOFD - Line feed / data direction control
- ERROR - Error condition / busy
- INIT - Initialize / reset
- SLCTIN - Select device

Video

The graphics controller iuterfaces the 16-bit video data bus with the 32-bit (four plane) video memory bus. This device also generates sync and other timing signals needed for video display. The controller uses four clock iuputs: master clock (synchronize internal 16-bit cycles), and three video colcks. Address and data information is multiplexed on the video bus.

Video data to the external CRT is transferred throught the color palette.When BLANK is asserted high, the output is enabled. VGA video is output usiug the R, G, and B signals.

Floppy Disk Drive

The floppy disk controller (FDC) provides interfacing between the CPU circuitry and the disk drives. One internal 3.5-inch disk drive is supported by the FDC. A 24 uegahertz crystal oscillator provides the FDC time base.

IOR is asserted by the CPU/bus controller iuitiating a read cycle. When FDCCS is low, data is read from the disk drive over RDATA. The FDC converts this to a parallel format used by the system and places the data on the bus (SD0-SD7).

Duriug a write cycle. LOW is issued, and parallel data from the system is converted to a serial format, then transmitted to the disk drive over WDATA. T/C indicates data transfer is complete.

Chapter 5
Disassembly

This chapter contains step-by-step instructions for disassembly. For rcasseinbly, perform the steps in the reverse order unless instructed otherwise. Read each section completely before disassembling the computer.

Statie Preeaution

To prevent component dainage from static discharges, use the following precautions.

- Do not remove any static-sensitive device from its protective packaging until you are ready to install it.
- Equalize the static electricity between the work surface, the device and you. Touch the work surface with one hand and then pick up the device with the other hand.
- Once you remove the device from its protective packaging, do not set it down or let go it until it is installed in the coinputer or returned to its protective packaging.

Removing the Keyboard

1. Turn on the computer and run the MS-DOS utility, or it's equivalent, before disassembly. Place a shipping insert(or a scratch disk) in the floppy drive.

Cautiou: Avoid a shock hazard. Unplug the computer and disconnect the line cord before beginning disassembly.

2. Turn off the computer and unplug it.

3. Disconnect any peripherals from the computer.

4. Place the computer top down on a soft cloth.

5. Remove and save the screw shown in Figure 5-1.

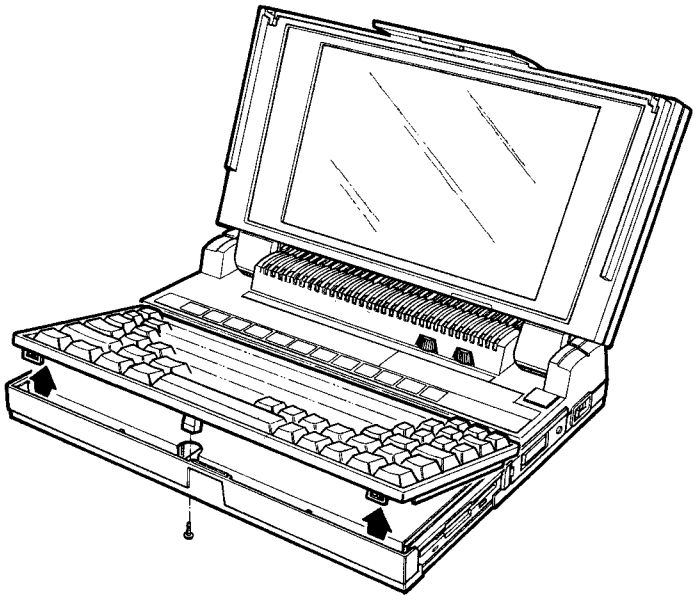


Figure 5-1 Keyboard Removal

6. Unloek and lift the keyboard from the bottom case.

7. Use a small flat-bladed screwdriver to release the lock tabs on each side of the keyboard connector.

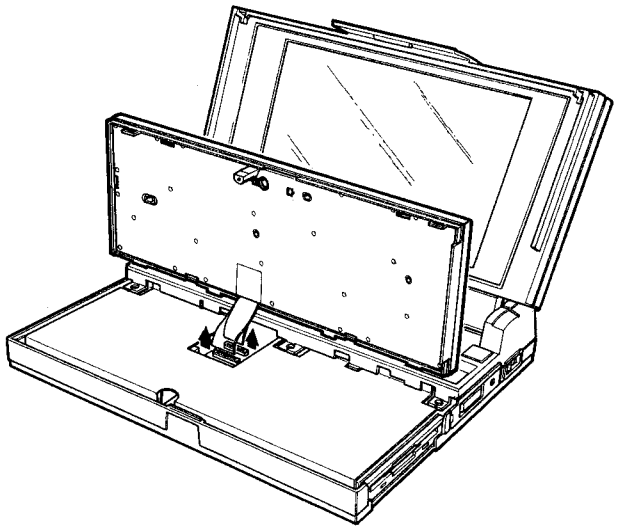


Figure 5-2 Keyboard Cable

8. Remove the keyboard cable from the I/O board.

9. Remove the keyboard.

Removing the Top Cover/Display

1. Remove the keyboard assembly as described earlier.

2. Remove the battery package shown in Figure 5-3

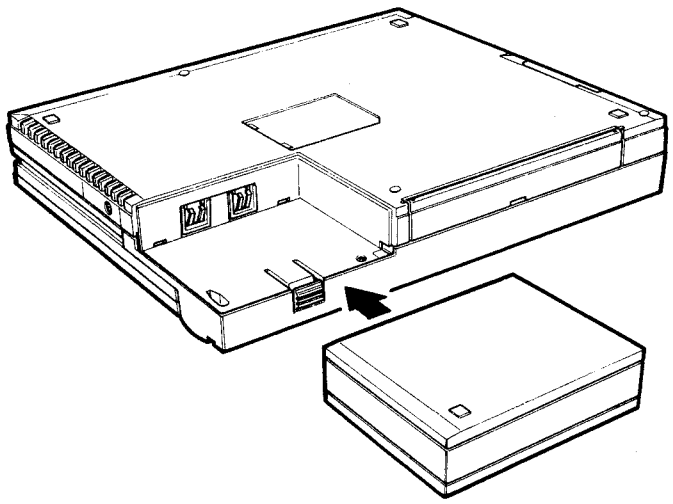


Figure 5-3 Battery Package Removal

3. Disconnect the DC to AC(CFL) cable from the DC-DC converter.

4. Remove and save the four screws in bottom shown in Figure 5-4.

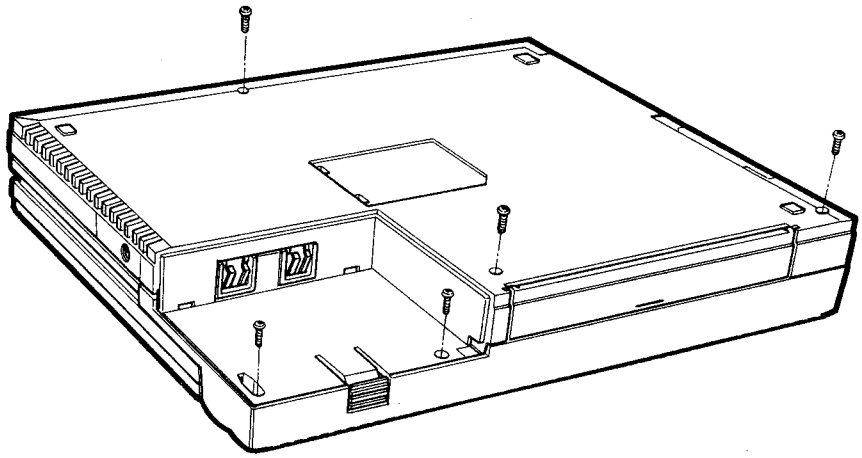


Figure 5-4 Bottom Secrews Removal

5. Remove the three screws in top side shown in Figure 5-5.

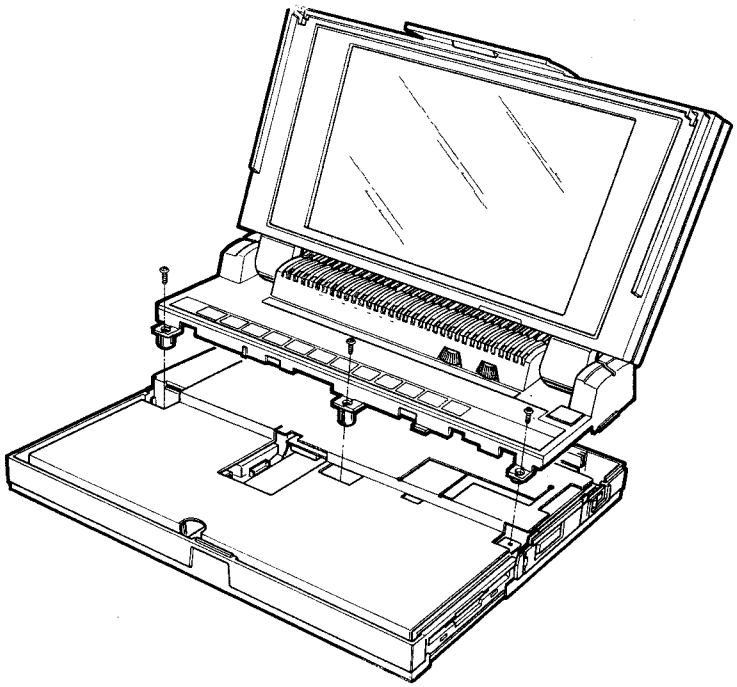


Figure 5-5 Top Side Screws Removal

6. Disconnect the display cables and the LED board cables connected to the system board.

7. Set the assembly aside with the display on top.

Removing the LED Board

Notice: Disconnecting the backup battery causes the loss of the Setup information. Record the configuration information before continuing.

1. Remove the keyboard as described earlier.

2. Remove the top cover/display assembly as described earlier.

3. Remove and save two screws shown in Figure5-6

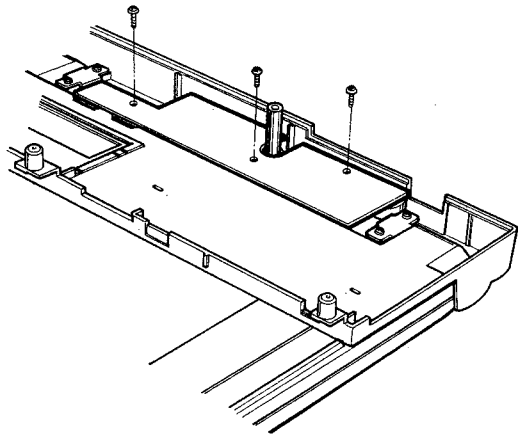


Figure 5-6 LED Board Removal

4. Remove the LED board.

Removing the Hard Disk Drive

Caution: Hard disk drives are very sensitive to shock. Be careful not to drop or jar the drive unit.

1. Remove the keyboard as described earlier.

2. Remove the top cover/display assembly as described earlier.

3. Remove the two screws and upper shield.

4. Remove and save the screws shown in Figure 5-7

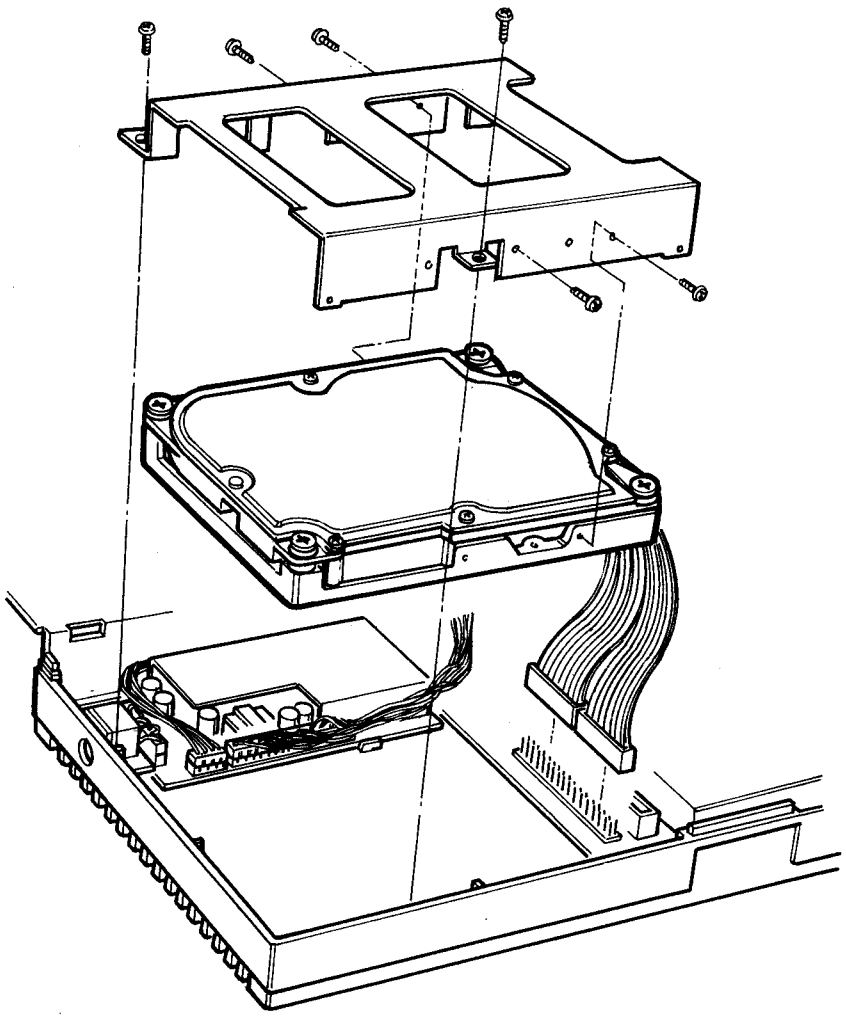


Figure 5-7 Hard Disk Removal

5. Carefully slide to right side and lift the drive.

6. Disconnect the power and interface eables from the I/O board.

7. Remove the four screws that secure the mounting bracket to the drive and remove the braket.

8. Remove the drive.

Removing the System Board

Cautiou: Observe statie precautions.

Noticc: Disconnecting the backup battery causes the loss of Setup information. Record the configuration information before contmuing.

1. Remove the keyboard as described earlier.

2. Remove the top cover/display assembly as described earlier.

3. Remove the screws to remove the uppershield shown in Figure 5-8.

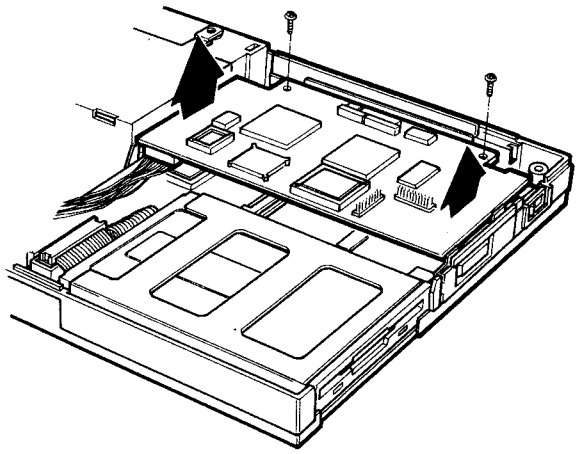


Figure 5- 8 Removing the System Board

4. Remove the screw between system board and FDD bracket.

5. Disconneet and lift the main board from the I/O board.

6. Disconnect the cable connected to the DC-to- DC converter.

Removing the Floppy Disk Drive

1. Remove the keyboard as described earlier.

2. Remove the top cover/display assembly as described earlier.

3. Remove the system board as described earlier.

4. Remove the screws shown in Figure 5-9

5. Slide the drive to left side of the computer and lift it.

6. Disconnect the cable from the I/O board.

7. Remove the four screws that secure the mounting bracket to the drive and remove the bracket.

8. Remove the drive.

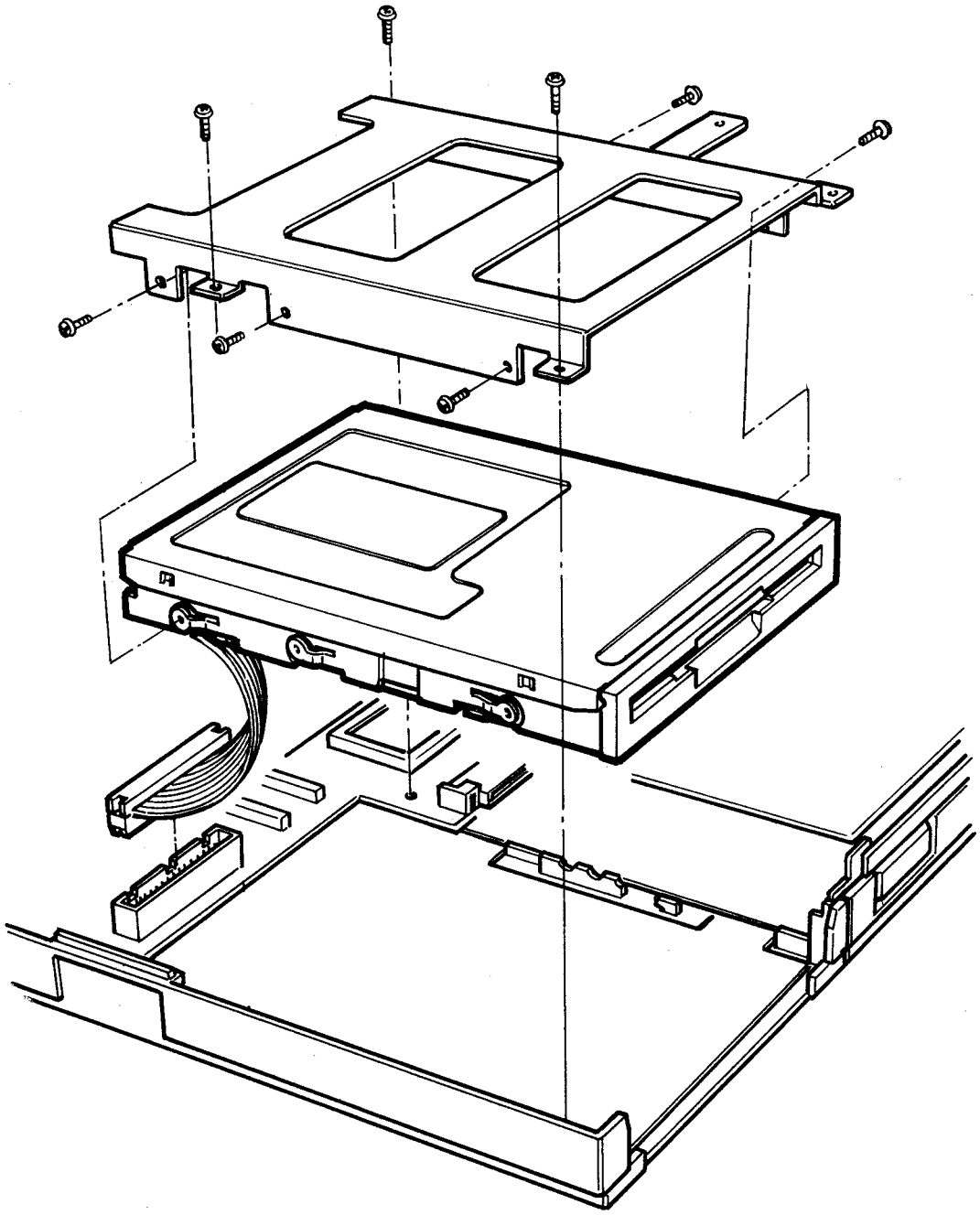


Figure 5- 9 Floppy Disk Drive Removal

Removing the DC-to-DC Converter

Cautiou: Avoid a shock hazard. Handle the DC-to-DC board carefully. Some capacitors may be charged even when the power cube is disconnected.

1. Remove the keyboard as described earlier.

2. Remove the top cover/display assembly as described earlier.

3. Remove the hard disk driver as described earlier.

4. Remove the system board as described earlier.

5. Disconnect the cable connected to the DC-to-DC converter shown in Figure 5-10.

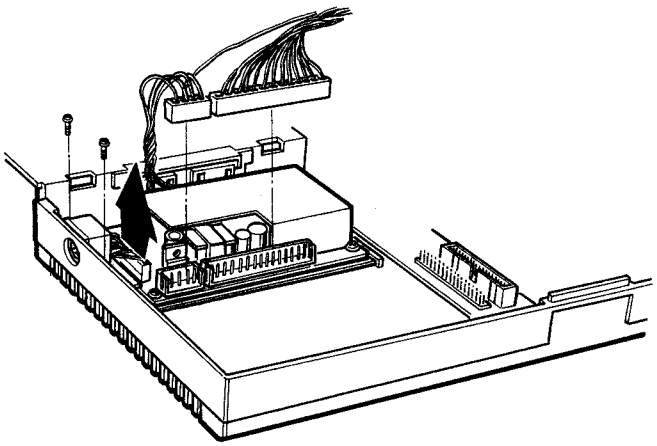


Figure 5- 10 Removal the DC-to-DC Converter

6. Remove the DC-IN board shown in Figure 5-11.

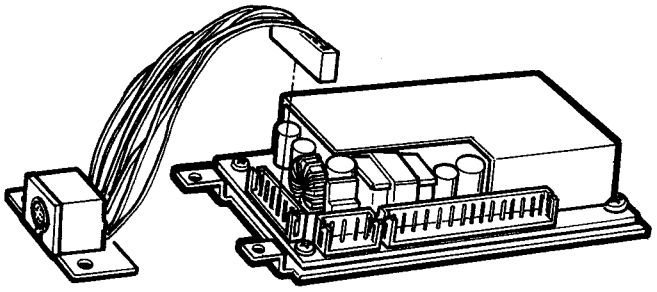


Figure 5-11 DC-IN Board Removal

7. Remove the converter assembly.

Chapter 6
Toubleshooting

This chapter provides computer troubleshooting information. This informaton is included to assist in diagnosing problems to the major assembly level.

Preliminary Checks

Remove the top cover/Display assembly and look for the following:

- Damage to the circuit boards or the chassis parts including:
  - Denoted or bent metal parts
  - Frayed, nicked, or cut cables
  - Visible cracks on circuit boards
  - Heat damage - (discoloration or melting)
  - Curushed or broken socket connectors
- Placement- Check all cards for proper seating in their connectors.
- Connections - Check all cable connections. Make certain each cable is positioned and connected properly. Make sure power and external connections are secure.
- Optional cards -Remove any optional card(s) not part of the base computer configuration.

Status LEDs

There are seven status LEDs in the computer.
Figure 6-1 illustrates the power status LED below the LCD panel.

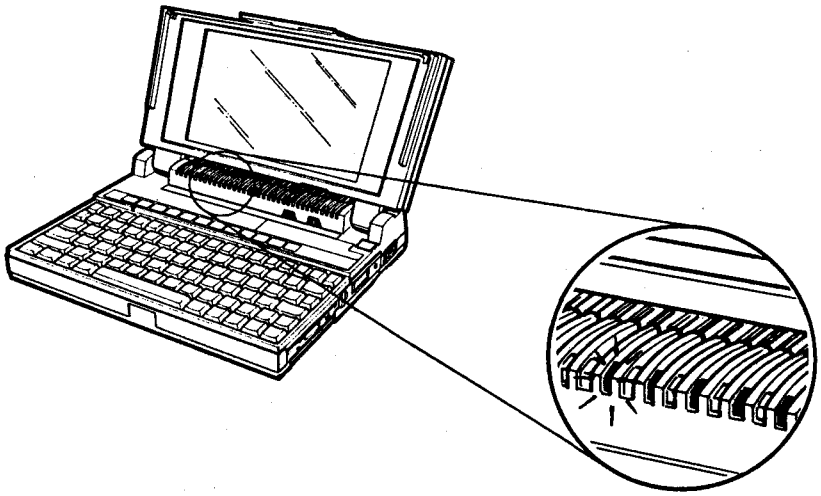


Figure 6-1 Power Status LED

Table 6-1 lists the conditions indicated by these LEDs.

Table 6-1 Power Status LED

Indication	Status
Green	Operating on AC or battery power
Amber(flashing)	Discharged battery.
Amber(steady)	Fully discharged battery.

The rest of LEDs indicate SUSPEND/RESUME, HDD/FDD, PAD LOCK, NUMBER LOCK, CAPS LOCK and SCROLL LOCK status.

Power Up

When power is applied, the computer begin an initialization proccss to check internal circuit and components. If the computer enounters a problem during this process, an error message appears on the monitor screen. (Refer to "Power-Up and Error Messages" later in this chapter for an explanation.) Soue initialization actions produce a visual or audible signal. The following general sequence of events should occur when power is applied to the computer:

1. The POWER LED lights.

2. The HDD/FDD LED flash amber.

3. The PAD LOCK, NUMBER LOCK, CAPS LOCK and SCROLL LOCK LEDs flash.

4. The NUMBER LOCK LED turns on.

5. The HDD/FDD LED flash green, then amber, then green again.

6. The screen displays:

```
PhoenixBIOS (TM) A386 Version X.XX
Copyright (C) 1985 - 1990 Pheonix Teohnologies Ltd.
All Right Reserved

Reference ID X.XXJ

640K Base Memory 00000K Extended
384K Shadow RAM 00000K Expanded
```

Note: If the display is not visible, adjust the contrast and brightness controls located below the LCD panel.

Troubleshooting Charts

The following charts are organized to simplify troubleshooting. Start with the general system troubleshooting chart. This chart provides immediate repair recommendations or directs you to other, more detailed charts. These charts identify the faulty assembly or recomment further tests to isolate the problem. Follow the sequence through until you locate and repair the problem.

Each block in the chart represents a step in troubleshooting the computer. Some blocks contain a smaller numbered block. The smaller block is a reference to the notes that appear on the troubleshooting charts.

Figure 6-3 General System Troubleshooting Chart

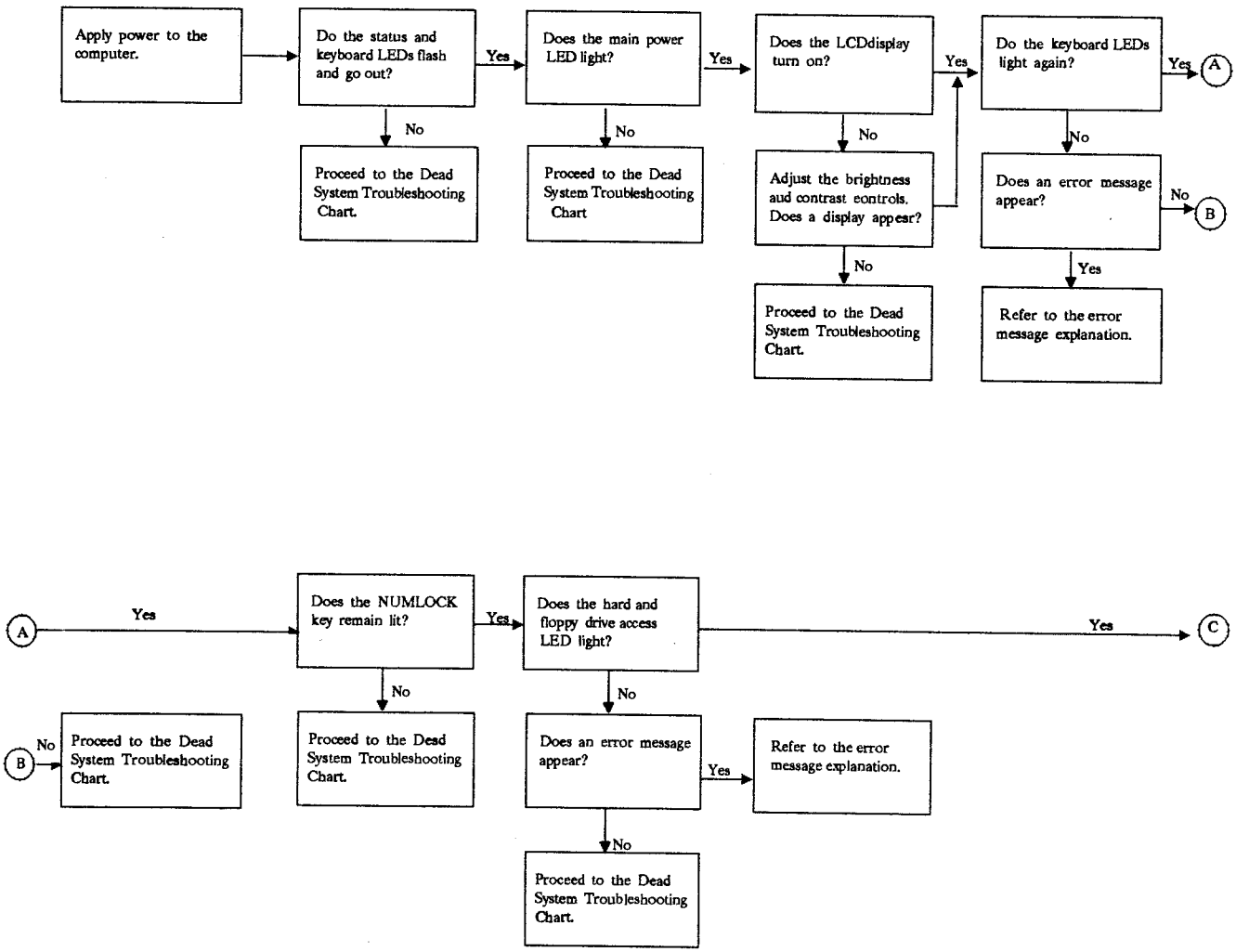


Figure 6-4 General System Troubleshooting Chart (Continued)

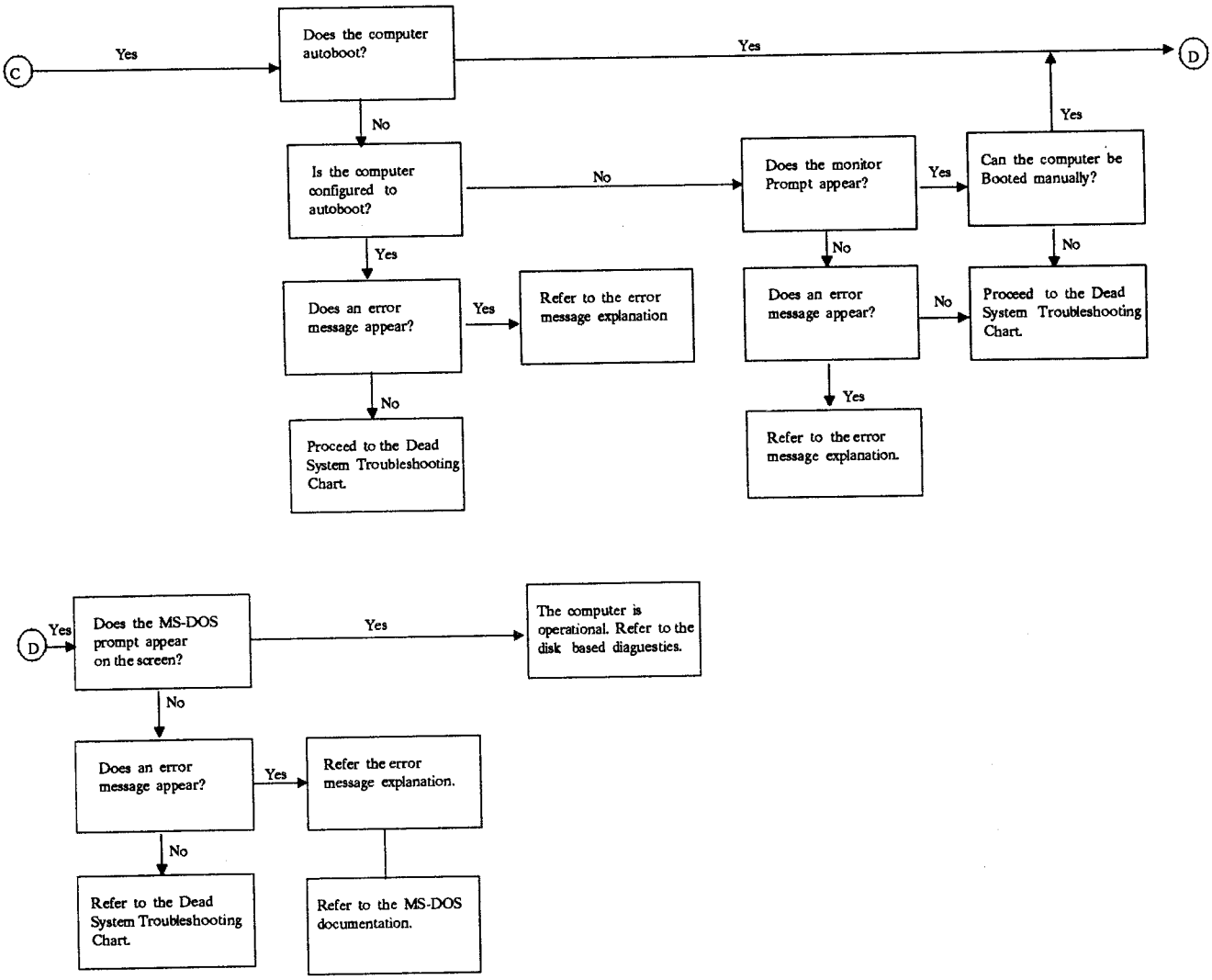
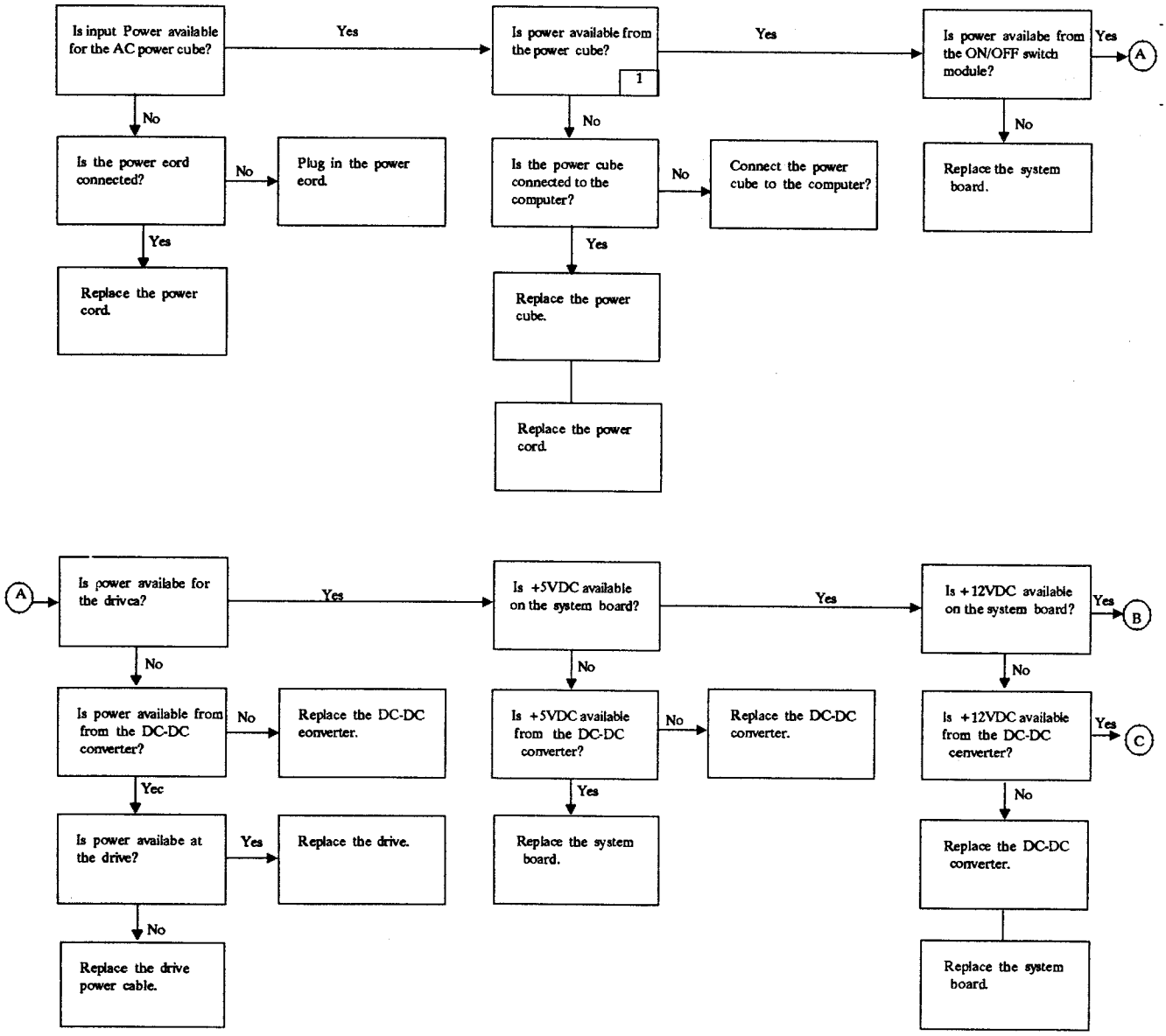
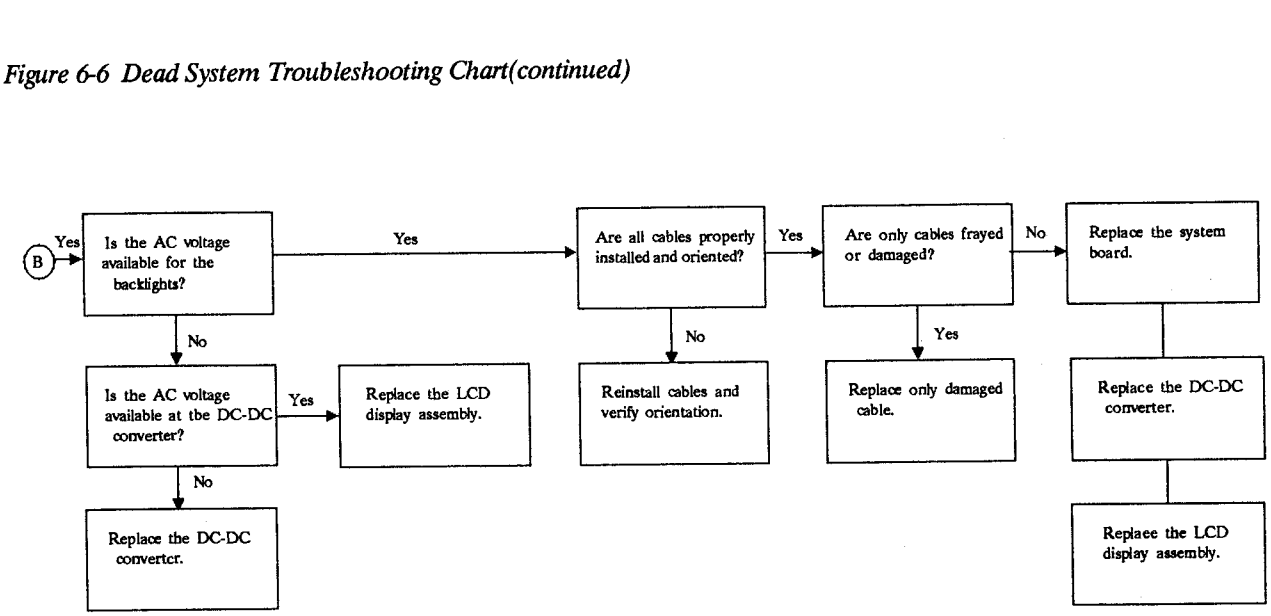


Figure 6-5 Dead System Troubleshooting



NOTES:
1. Refer to the Specifications section in the manual.

Figure 6-6 Dead System Troubleshooting Chart(continued)



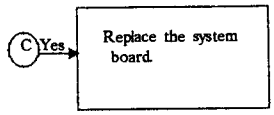
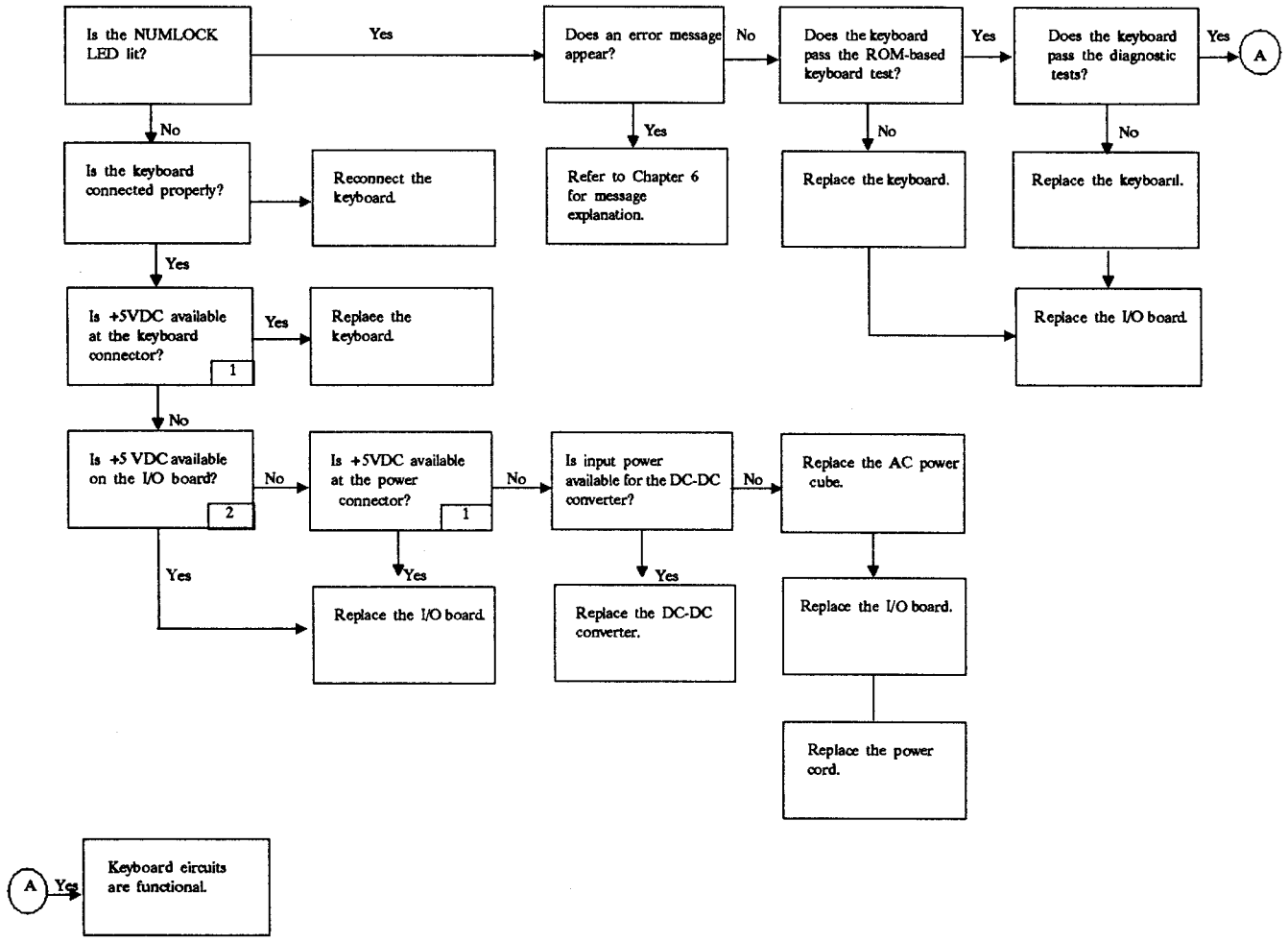


Figure 6-7 Keyboard Troubleshooting Chart



NOTES:
1. Refer to the "Specifications" section for connector pinouts.
2. +5VDC is available on the VCC pin of most IC's.

Figure 6-8 Parallel/Serial Port Troubleshooting Chart

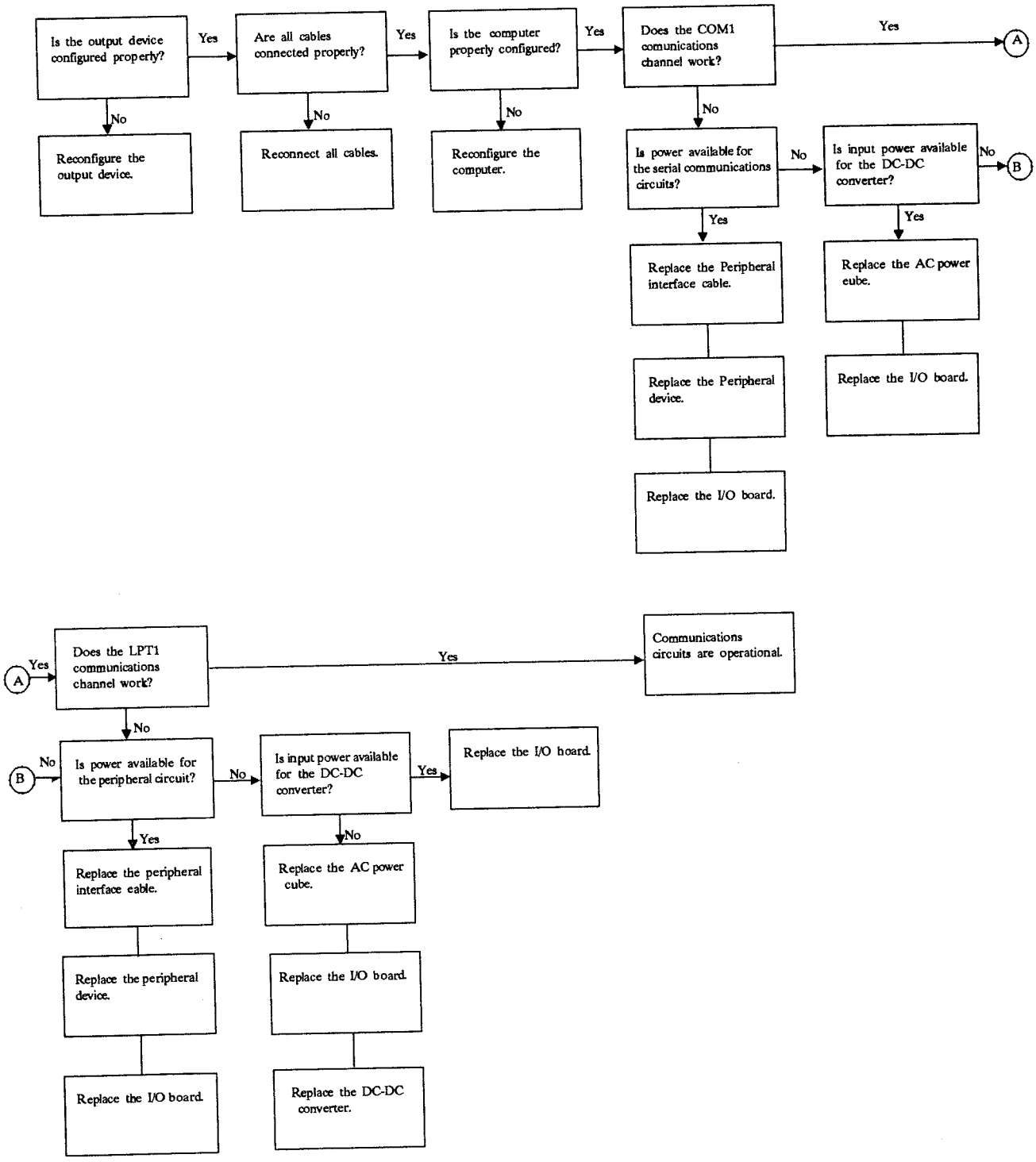


Figure 6-9 Drive Troubleshooting Chart

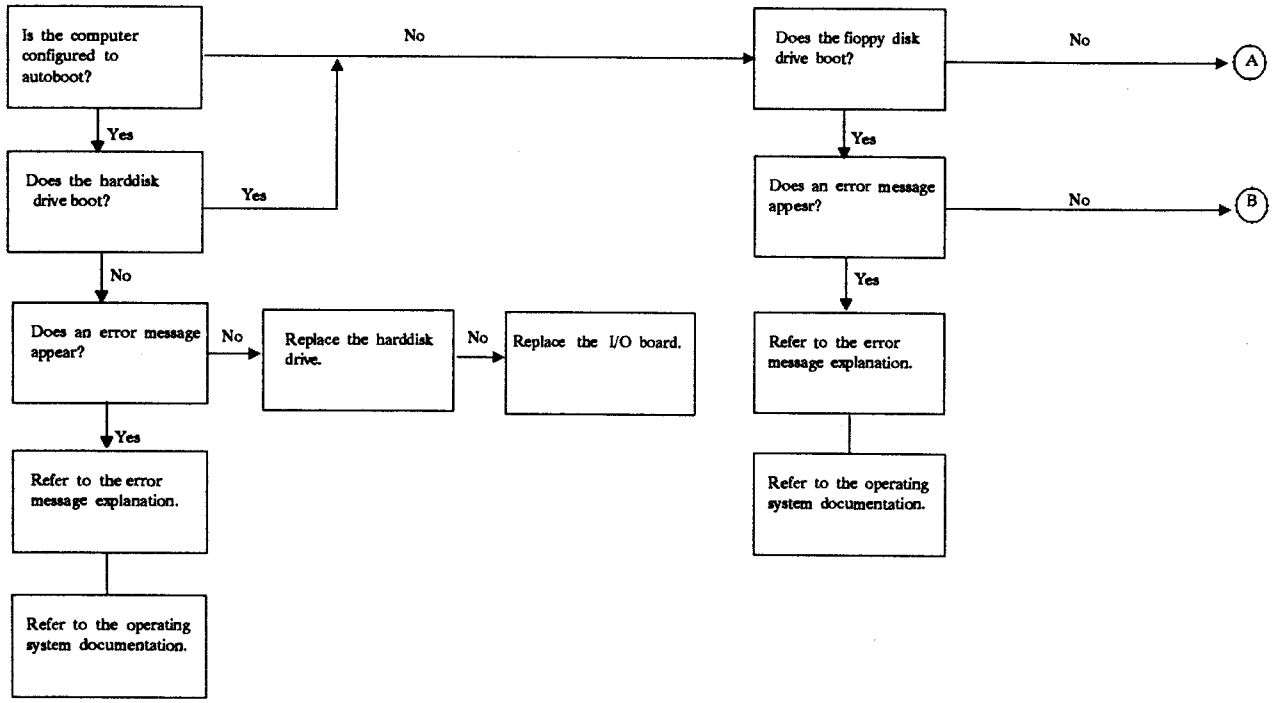


Figure 6-10 Drive Troubleshooting Chart(continued)

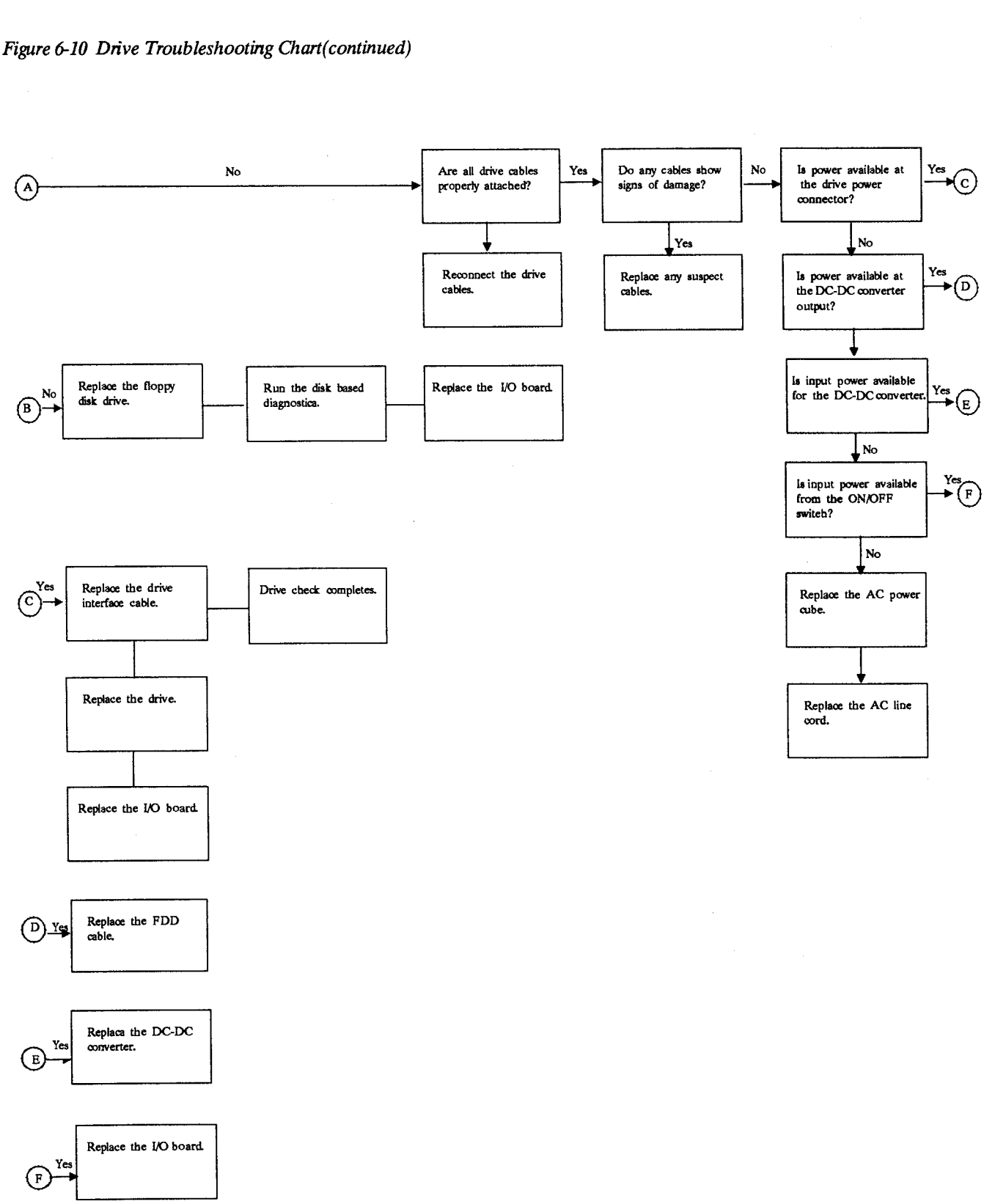


Figure 6-11 Internal LCD Video Troubleshooting Chart

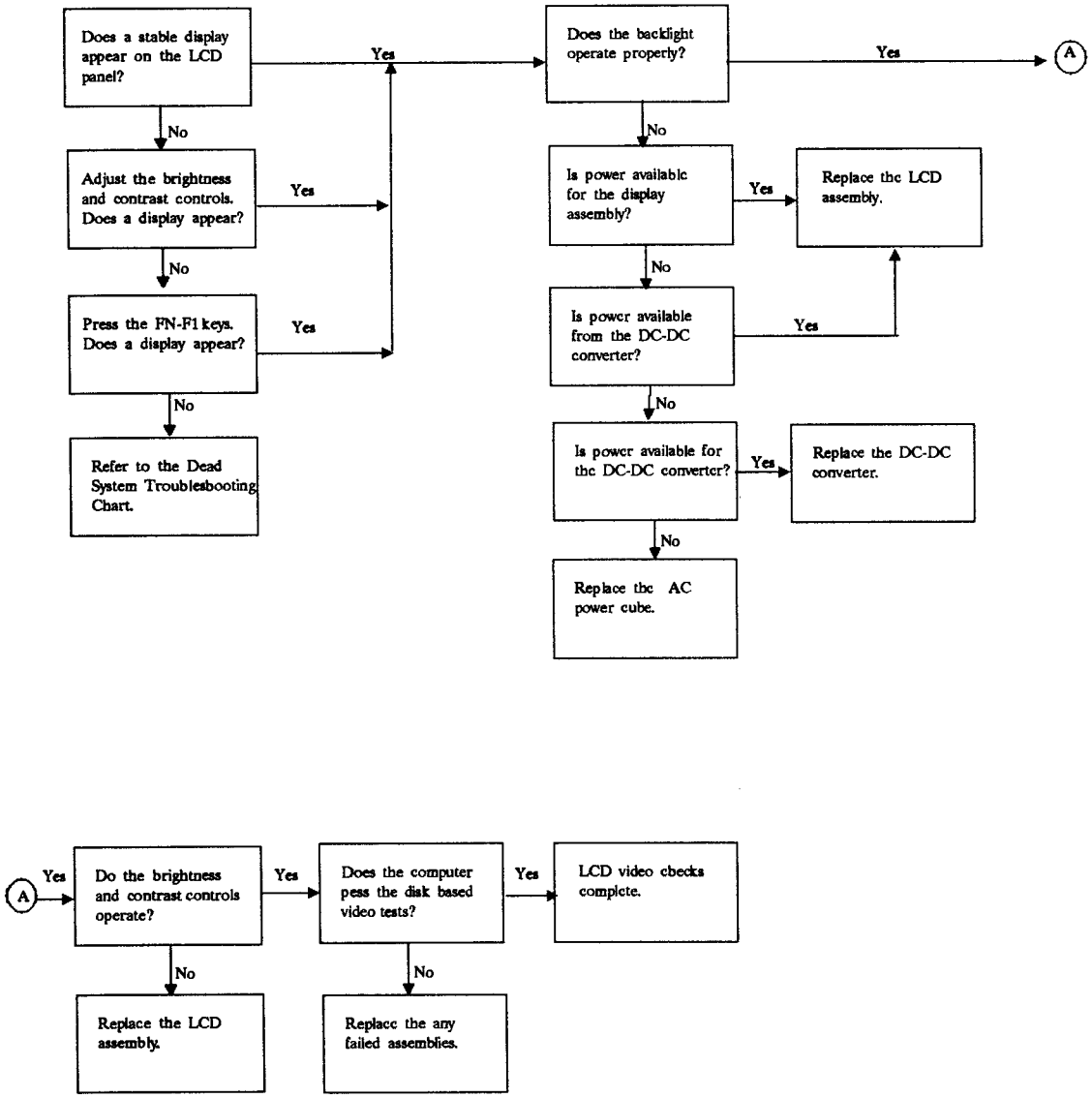
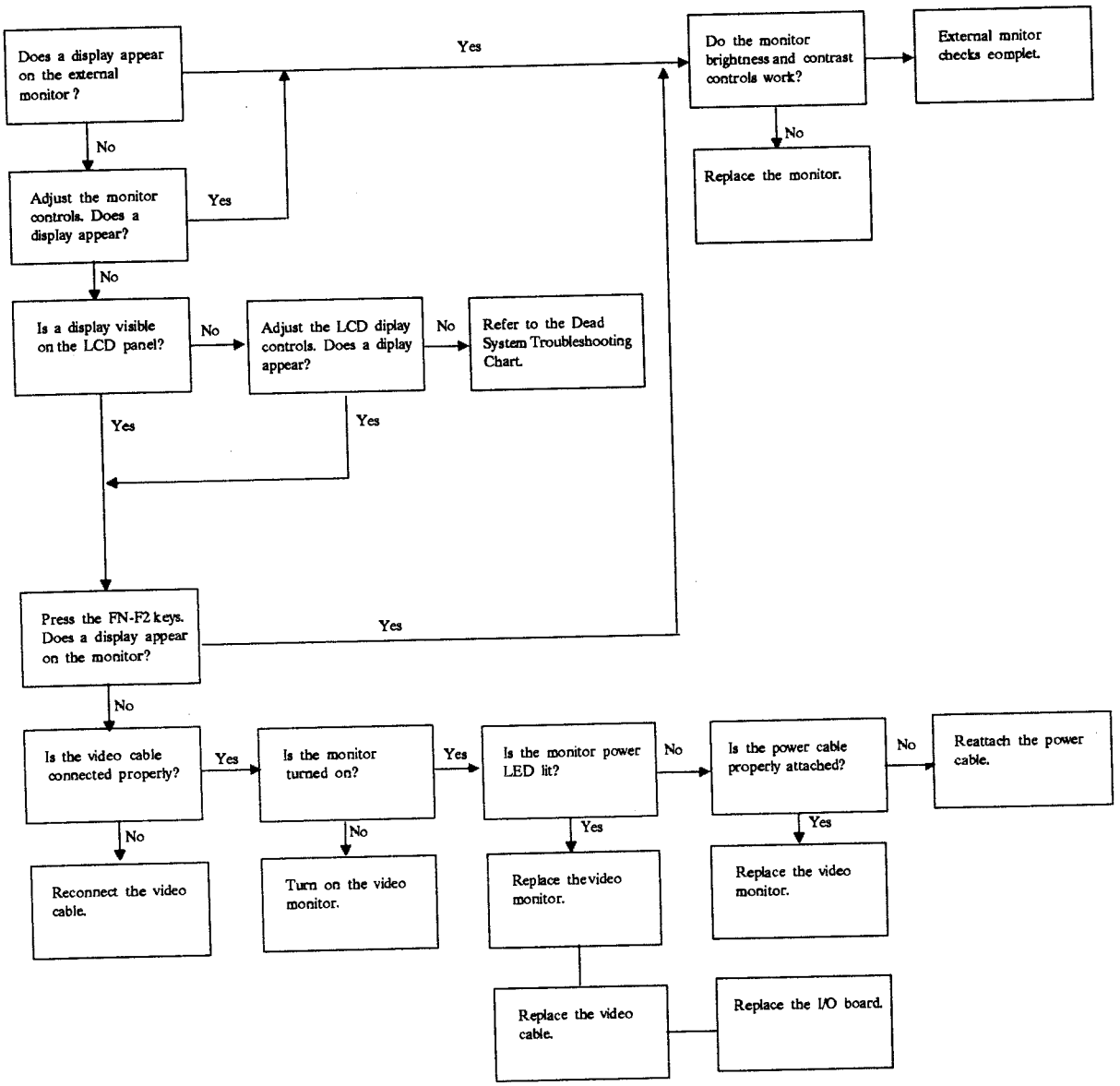


Figure 6- 12 External Video Troubleshooting Chart



Error Codes And Messages

Beep Codes For Post Error

Sometimes POST errors cannot be reported on the screen. When an error occurs before the screen is initialized or when the system is set to loop on the system board tests, then the screen cannot display the error message. Beep codes are used to identify a POST error that occurs when the screen is not available.

When you hear any beep sounds like next page , turn the system power off and back on again. If the same beep sound is heard again, contact the dealer.

Fatal System Board Errors

Beep	CodePort 80h	Description
none	01h	CPU register test in progress
1-1-3	02h	CMOS write/read failure
1-1-4	03h	ROM BIOS checksum failure
1-2-1	04h	Programmable interval timer failure
1-2-2	05h	DMA initialization failure
1-2-3	06h	DMA page register write/read failure
1-3-1	08h	RAM refresh verification failure
none	09h	First 64K RAM test in progress
1-3-3	0Ah	First 64K RAM chip or data line failure multi-bit
1-3-4	0Bh	First 64K RAM odd/even logic failurc
1-4-1	0Ch	Address line failnre first 64K RAM
1-4-2	0Dh	Parity failure first 64K RAM
2-1-1	10h	Bit 0 first 64K RAM failure
2-1-2	11h	Bit 1 first 64K RAM failure
2-1-3	12h	Bit 2 first 64K RAM failure
2-1-4	13h	Bit 3 first 64K RAM failure
2-2-1	14h	Bit 4 first 64K RAM failure
2-2-2	15h	Bit 5 first 64K RAM failure
2-2-3	16h	Bit 6 first 64K RAM failure
2-2-4	17h	Bit 7 first 64K RAM failure
2-3-1	18h	Bit 8 first 64K RAM failure
2-3-2	19h	Bit 9 first 64K RAM failure
2-3-3	1Ah	Bit 10 first 64K RAM failure
2-3-4	1Bh	Bit 11 first 64K RAM failure
2-4-1	1Ch	Bit 12 first 64K RAM failure
2-4-2	1Dh	Bit 13 first 64K RAM failure
2-4-3	1Eh	Bit 14 first 64K RAM failure
2-4-4	1Fh	Bit 15 first 64K RAM failure
3-1-1	20h	Slave DMA register failure
3-1-2	21h	Master DMA register failure
3-1-3	22h	Master interrupt mask register failure
3-1-4	23h	Slave interrupt mask register failure
none	25h	Interrupt vector loading in progress
3-2-4	27h	Keyboard controller test failure
none	28h	CMOS power failure and checksum ealculationin progress
none	29h	CMOS configuration validation in progress
3-3-4	2Bh	Screen memory test failure
3-4-1	2Ch	Screen initialization failure
3-4-2	2Dh	Screen retrace test failure
none	2Eh	Search for video ROM in progress
none	30h	Screen running with video ROM
none	31h	Monochrome monitor operable
none	32h	Color monitor (40 column) operable
none	33h	Color monitor (80 column) operable

Non fatal System Board Errors

Beep Code	Port 80h	Description
4-2-1	34h	Timer tick interrupt test in progress or failure
4-2-2	35h	Shutdown test in progress or failure
4-2-3	36h	Gate A20 failure
4-2-4	37h	Unexpected interrupt in protected mode
4-3-1	38h	RAM test in progress or address failure > FFFFh
4-3-3	3Ah	Interval timer channel 2 test or failure
4-3-4	3Bh	Time-of-Day clock test in progress
4-4-1	3Ch	Serial port test or failure
4-4-2	3Dh	Parallel port test or failure
4-4-3	3Eh	Math coprocessor test or failure

Setup Error Messages

The followings describes the error messages that SETUP utility could return. The SETUP utility may not generate an error message if the incorrect diskette drive information is supplied.

Clock chip lost power (*hit any key to continue*)

Canse: The clock chip is not working.

Solution: Run the SETUP utility; check all configuration settings.

CMOS checksum invalid (*hit any key to continue*)

Cause: There is a configuration error.

Solution: Run the SETUP utility; check all configuration settings.

Incorrect configuration data in CMOS (*hit any key to continue*)

Cause: Configuration data entered in the SETUP utility is not the same as the actual system components.

Solntion: Run the SETUP utility. Verify all settings are eorrect. If the error persists, replace the system board.

Memory size in CMOS invalid (*hit any key to continue*)

Cause: Wrong base memory set.

Solutiou: Run the SETUP utility; correct the error in the Base Memory field.

Disk C: failed initialization (*hit any key to continue*)

Cause: Incorrect the fixed-disk drive type.

Solution: Run the SETUP utility; correct the Fixed-Disk setting.

Time or date in CMOS is iuvalid (*hit any key to continue*)

Cause: The system clock time/date is not the same as that entered in the SETUP utility.

Solution: Run the SETUP utility; correct the date or time field.

Chapter 7
Parts List

Table 7-1 lists all serviceable parts for the computer.These parts are cross-referenced to the exploded views provided in Figures 7-1 and 7-2. Table 7-2 lists optional parts for the computer.

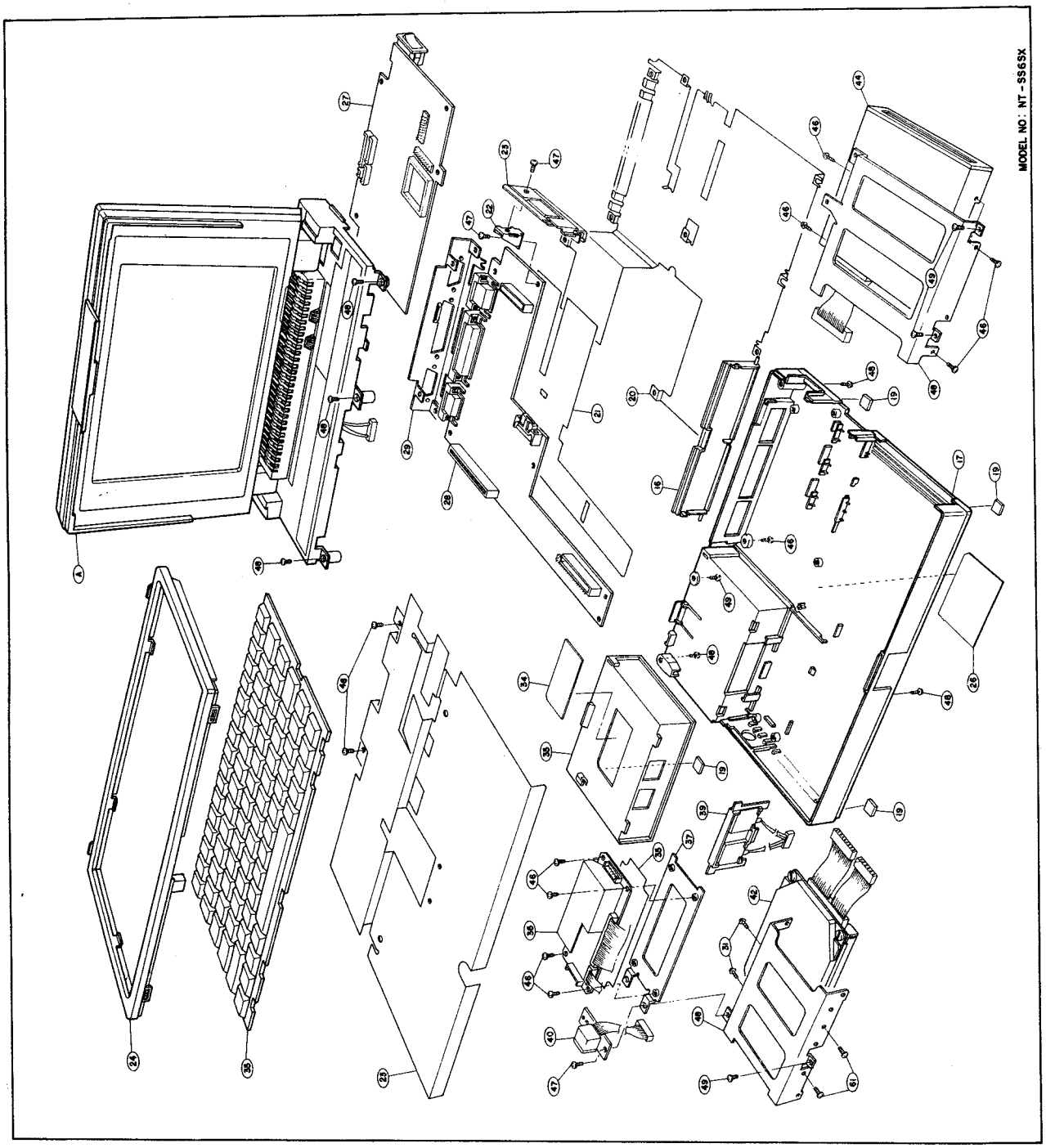


Figure 7-1 Base Assembly Exploded View

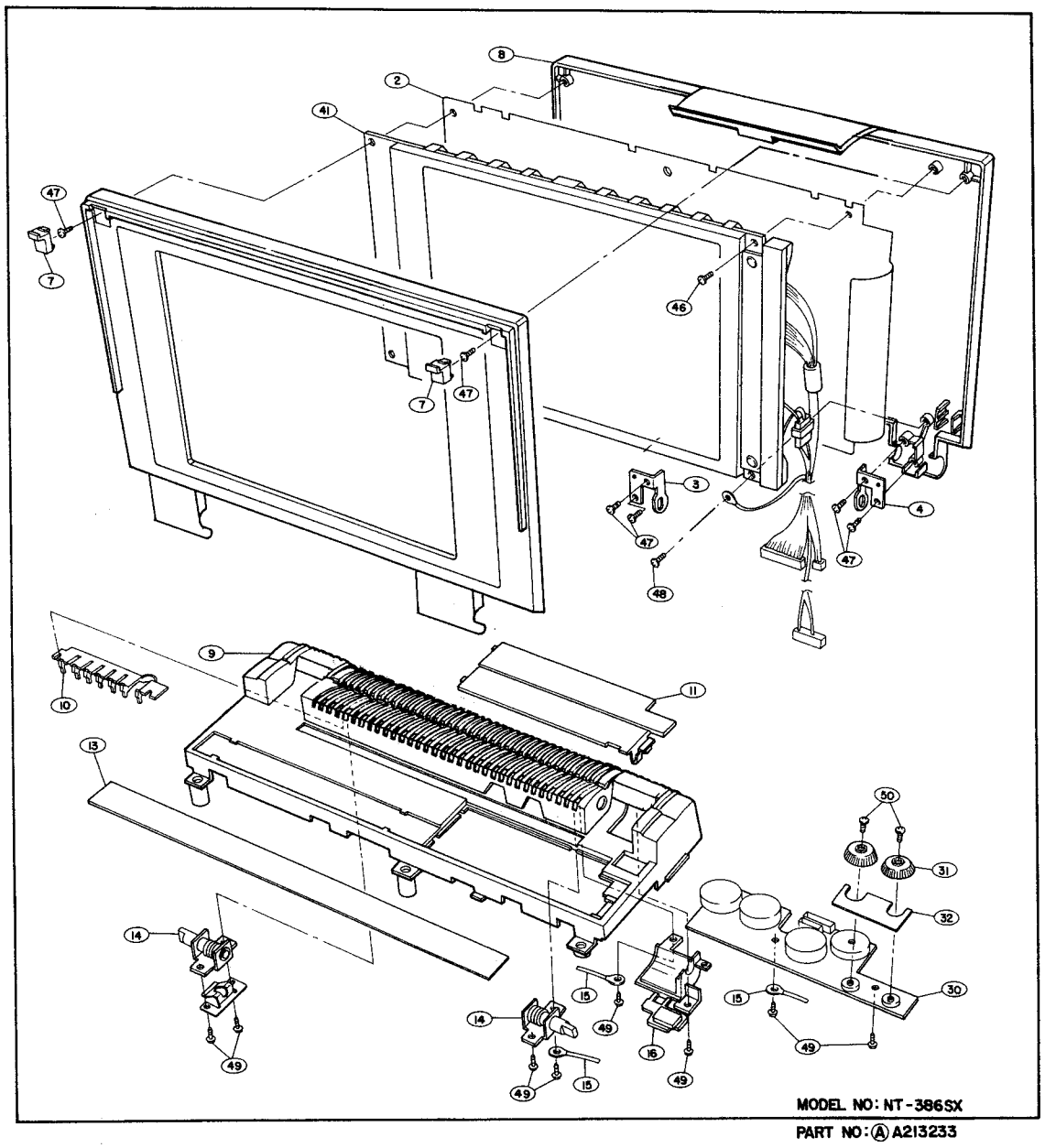


Figure 7-2 Upper Cabinet/LCD Display Assembly

Notice: Items marked with an asterisk in the following tables are considered "field replaceable."

Table 7-1 Parts List

Ref Number	Part Number	Description
Brackets		
3	235-551A	Braket, Tilt left
4	235-552A	Braket, Tilt Right
22	325-553A	Braket, Modem Plate
43	235-550A	Braket, HDD 2.5"
45	235-549A	Braket, FDD 3.5" Slim
Cases		
8	A213239B	Case, Rear Display
9	213-301B	Case, Top Logic
16	213-304A	Case, Cable Guide
17	213-286Z	Case, Bottom Logic
24	213-291A	Case, Top Keyboard
Plates		
2	421-689A	Plate, Shield Display
20	421-671A	Plate, Shield Logic
21	421-678A	Plate,Insulation Logic
23	421-674A	Plate, Shield CPU Board 386
29	421-668A	Plate,SIO / PIO Port
32	421-680A	Plate, Insulation Volume
38	421-675A	Plate, Insulation DC-DC
39	A644694A	Connector Ass'y Battery & DC-DC
Asscmblys		
1	213-302A	Case, Front Display
14	A327015A	Assembly, Hinge Tilt Mechanism
25	A215171A	Assembly, Cover Modem W/Plate
27	A611994B	Assembly, PCB Mother Board 386
30	P611997A	Assembly, BOM Common,LED Board
33	A632002A	Assembly, Battery Package
35	A265381A	Assembly, Keyboard, 81 Keys US
36	A637003A	Assembly, DC-DC Converter
40	A611995A	Assembly, DC-In Board
41	421-385B	Plate, Ground Finger
Screws		
46	IMPC0301418	Screw, Machine D3.0 L4.0
47	IMPC0302022	Screw, Machine D3.0 L6.0
48	IMPC0302422	Screw, Machine D3.0 L8.0
49	IBPF0302418	Screw, Tap Tite D3.0 L8.0
50	IBPF0302818	Screw, Tap Tite D3.0 L12.0
51	IBPF0302018	Screw, Tap Tite D3.0 L6.0
Lables		
13	593-817A	Label, KBD Fnnction
26	593-599A	Label, ID
34	593-596A	Label, ID Battery Package
Disk Drives		
42	P153086A	HDD, 2.5 Inch, 40MB
44	P151523A	FDD, 3.5 Inch 1.44MB
Covcrs		
11	215-501A	Cover, Memory & Coprocessor
18	519-003A	Door, SIO/PIO Port

Table 7-1 Parts List

Ref Number	Part Number	Description
PCB		
28	A611999A	PCB, I/O Board
Miseellaneous		
7	391-106A	Cushion, Rubber Display
10	525-328A	Lenz, LED(7)
15	333-076A	Clamp,Retainer Coil
19	471-105A	Rubber, Foot Bottom Logic
31	267-388A	Knob, Brightness/Contrast
37	424-095A	Heat Sink, DC-DC

Table 7-2 Optional Parts

Part Number	Description
Memory Expansion	
185-116B	2 MB memory expansion card
Power	
630-002B	Battery pack assembly
636-003C	AC/DC adapter assembly
Commuuication	
185-302B	Modem card assembly

Specifications

CPU

Host Processor: Intel 80386SX, 16-bit external/32-bit internal mieroprocessor.

Clock Speed: 10/20 MHz, Slow mode runs at 10MHz for compatibility and power conservation.

Coprecessor: Optional Intel 20/32-bit 80387SX.

Memory

Base: Two megabytes.

Expansion: Four megabytes maximum using on 2M expansion board.

Configuration: 640K base memory; EMS memory; and extended memory (up to limit of installed memory), selectable from the SETUP program.

Expansion Memory Connector (J7)

Pin	Signal	Pin	Signal
1	Vcc	10	MA(0)
2	Vcc	11	MA(1)
3	MA(2)	12	MA(9)
4	MA(3)	13	$\overline{\text{MA(10)}}$
5	MA(4)	14	$\overline{\text{MRAS1}}$
6	MA(5)	15	$\overline{\text{MCAS3}}$
7	MA(6)	16	$\overline{\text{MCAS2}}$
8	MA(7)	17	$\overline{\text{MWE}}$
9	MA(8)	18	$\overline{\text{MOE}}$

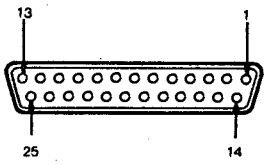
Expansion Memory Connector (J8)

Pin	Signal	Pin	Signal
1	D(0)	10	D(9)
2	D(1)	11	D(10)
3	D(2)	12	D(11)
4	D(3)	13	D(12)
5	D(4)	14	D(13)
6	D(5)	15	D(14)
7	D(6)	16	D(15)
8	D(7)	17	Ground
9	D(8)	18	Ground

Input/Output

Parallel Port:

One 25-pin Centronics-type parallel port (DB-25 type connector). Configured as LPT1.



Parallel Port Connector

Pin	Signal	Pin	Signal
1	Strobe	10	Acknowledge
2	Data bit 0	11	Busy
3	Data bit 1	12	Paper end(out)
4	Data bit 2	13	Select (from printer)
5	Data bit 3	14	Auto feed
6	Data bit 4	15	Error
7	Data bit 5	16	Initialize printer
8	Data bit 6	17	Select(to printer)
9	Data bit 7	18-25	Ground

Serial Port:

One RS-232C asynchronons serial prot (DB-9 type connector):

Bits:

One start bit; 7- or 8-bit word length: one or two stop bits.

Baud rates:

Selectable: 110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud (MS- DOS options).

Handshaking:

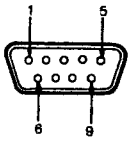
RD, CTS, DSR, CD signals recognized; TD, RTS, DTR control signals generated.

Protocal:

Half or full-dnplex operation.

Port Addresses:

COM1: 03F8H - 03FFH
COM2: 02F8H - 02FFH



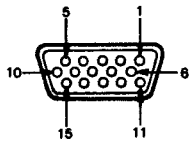
Serial Port Connector

Pin	Signal
1	Carrier detect (CD)
2	Receive data (RXD)
3	Transnrit data (TXD)
4	Data terminal ready
5	Signal gronnd (GND)
6	Data set ready (DSR)
7	Reqnest to send (RTS)
8	Clear to send (CTS)
9	Ring indicate (RI)

Video

Display

640 x 480 pixel black on white liquid crystal display with full transflective electrouminescent backlighting.

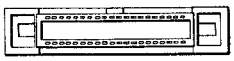


15 -Pin Video Connector

Pin	Signal
1	Red video output
2	Green video output
3	Blue video output
4	Not used
5	Not used
6	Red video ground
7	Green video ground
8	Blue video ground
9	No pin
10	Digital ground
11	Ground
12	Not used
13	Horizontal sync
14	Vertical sync
15	Not used

Modem

Optional Hayes-compatible 300/1200/2400 bps modemwith RJ-11 modular connector. Configurable as COM1 or COM2.



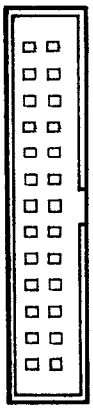
20 -Pin Modem Connector

Pin	Signal	Pin	Signal
1-2	Vcc	10	RING
3	Ground	11	Vcc
4	SOUT2	12-13	Ground
5	$\overline{\text{RTS2}}$	14	SIN2
6	$\overline{\text{DSR2}}$	15	$\overline{\text{DTR2}}$
7	$\overline{\text{CTS2}}$	16	$\overline{\text{DCD2}}$
8	$\overline{\text{COM2}}$	17	$\overline{\text{RI2}}$
9	Modem Sound	18-19	Ground
		20	Vcc (Modem)

Disk Drives

Floppy:

One 3.5-inch, 720KB/1.44M floppy disk drive standard. Write proctection reeognized.

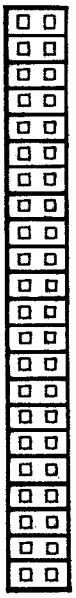


Floppy Disk Connector

Pin	Signal	Pin	Signal
1	Vcc	14	STEP
2	INDEX	15	Ground
3	Vcc	16	WDATA
4	DR0	17	Ground
5	Vcc	18	WGATE
6	DSKCHG	19	Ground
7	Vcc	20	TRK0
8	Not used	21	Ground
9	Vcc	22	WPROT
10	MTR0	23	Ground
11	RPM/LC	24	RDATA
12	DIR	25	Ground
13	Ground	26	HDSEL

Hard:

One 2.5-inch hard disk drive(40 megabytes); 1:1 interleave, 19msec access time.

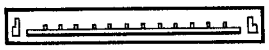


Hard Disk Connector

Pin	Signal	Pin	Signal
1	RESET DRV	23	IOW
2	Ground	24	Groimd
3	SD(7)	25	IOR
4	SD(8)	26	Ground
5	SD(6)	27	Not used
6	SD(9)	28	Not used
7	SD(5)	29	Not used
8	SD(10)	30	Ground
9	SD(4)	31	IRQ14
10	SD(11)	32	IOCS16
11	SD(3)	33	SA(1)
12	SD(12)	34	Not used
13	SD(2)	35	SA(0)
14	SD(13)	36	SA(2)
15	SD(1)	37	HCS0
16	SD(14)	38	HCS1
17	SD(0)	39	HDD LED
18	SD(15)	40	Ground
19	Ground	41	Vcc
20	KEY	42	Vcc
21	not used	43	Ground
22	Ground	44	Vcc

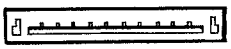
Keyboard

Standard: 80-Key keyboard inclnding alphanumeric, cursor control, uumeric, and Programmable function keys. Emulation features support full 101-key option.



Keyboard Conneetor

Pin	Signal	Pin	Signal
1	X(10)	7	X(4)
2	X(9)	8	X(3)
3	X(8)	9	X(2)
4	X(7)	10	X(1)
5	X(6)	11	X(0)
6	X(5)	12	Not used



Keyboard Connector

Pin	Signal	Pin	Signal
1	Not used	6	Y(4)
2	Y(0)	7	Y(5)
3	Y(1)	8	Y(6)
4	Y(2)	9	Y(7)
5	Y(3)	10	Not used

Power

AC Adapter:

Input: 100 -240 VAC 50/60 Hz 1A Maximum.

Output: 11 VDC at 35 W Maximum.

DC to DC:

Input: 6-11 VDC

Output: + 5 VDC at 3.75A, 4.6A surge, ripple 50mV p-p.
+ 12 VDC at 0.1A, 0.2A surge, ripplc 100mV p-p.
- 26 VDC at 40mA, ripple 200 mV p-p.
1000 VAC/open load
350 VAC, 5mA(lamp strike)

Battery Pack: 7.2 VDC, 2800 mA, with overcharge protection. Typical life is 500 charge/discharge cycles.

Initial Charge Time: 10 to 20 hours

Normal Recharge Time: 1.5 hours

Backup Battery:	3.6 VDC at 50mA NiCad. Provides backup power to real-time clock and CMOS mcmory.
Suspend/Resume Battery:	7.2 VDC at 50mA NiCad. Provides enough power to maintain suspend mode for 1 hours if the main battery pack is fully discharged.

Audio

Speaker:	Single channel through a miniature transducer

Euvironment

Temperature:

Operating:	50° to 95°F(10°to 35°C) at 10% to 80% relative humidity.
Non-Operating:	32° to 140°F(0°to 60°C) at 10% to 80% relative humidity.

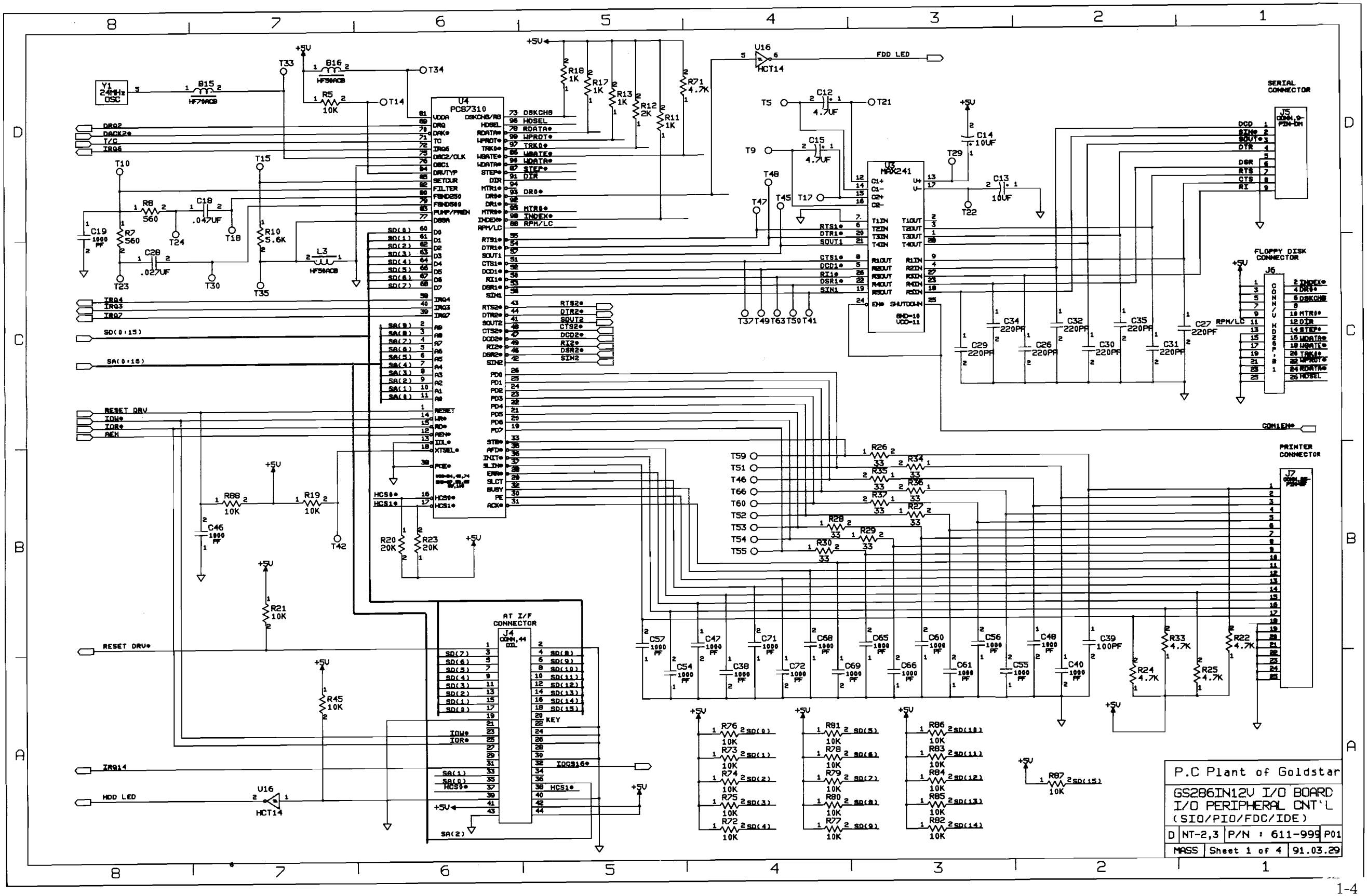
Altitude:

Operating:	10,000 feet.
Non-Operating:	40,000 feet, maximum.

Size

Computer:	8.6 x 11.02 x 2.17 inches (218.4 mm x 279.9 mm x 55.1 mm).
Weight:	Under 7.0 lbs (3.18 Kilograms) with battery pack.

Manufacturer reserves the right to discontinue products and to change specifications at any time without notice. Manufacture is not obligated to make these changes to previonsly sold products.


U4
PC87310
U3
MAX241
U16
HCT14
J4
AT I/F CONNECTOR
J5
SERIAL CONNECTOR
J6
FLOPPY DISK CONNECTOR
J7
PRINTER CONNECTOR
FDD LED
HDD LED
RESET DRV
RESET DRV*
IRQ14
SD(0:15)
SA(0:16)
P.C Plant of Goldstar
GS286IN12V I/O BOARD
I/O PERIPHERAL CNT`L
(SIO/PIO/FDC/IDE)
D | NT-2,3 | P/N : 611-999 | P01
MASS | Sheet 1 of 4 | 91.03.29

P.C Plant of Goldstar			
GS286IN12V I/O BOARD			
VGA/PANEL CONTROLLER			
D	NT-2/3	P/N : 611-999-P02	
	MASS	Sheet 2 of 4	91.04.24

LARGER VALUE THAN 10K

+5V VIDEO

VIDEO CONN

HCT245

HCT244

HCT00

HC7PACK

MT4C1664

M90C20

90C61

2N3904

MBR3520

74HC4316

74HC4066

74HC4053

74HC4040

74HC4020

74HC4538

74HC4538

74HC4538

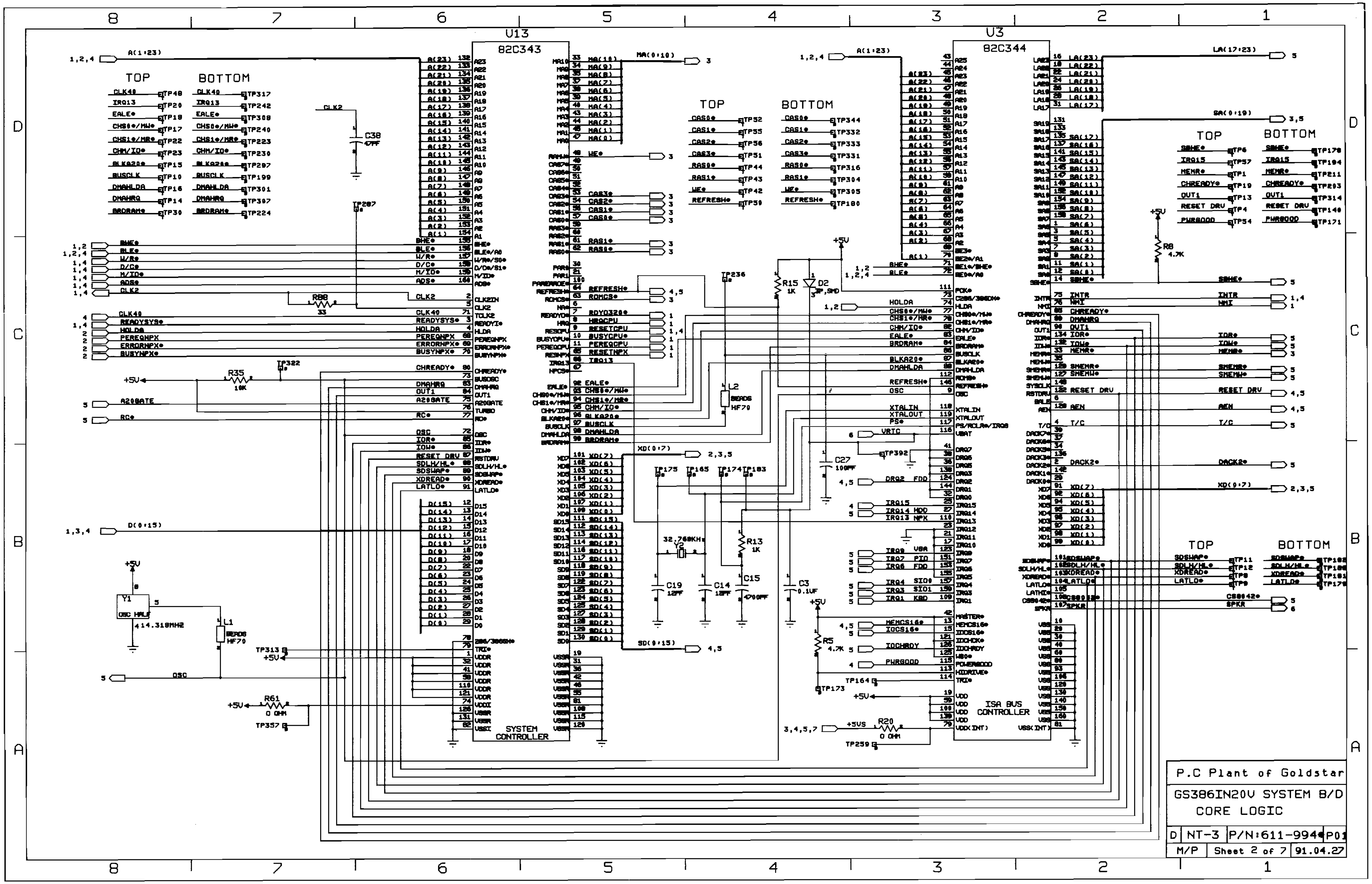
P.C Plant of Goldstar

GS386IN20V SYSTEM B/D

MICROPROCESSOR & MATH COPROCESSOR

D | NT-3 | P/N:611-9944P00

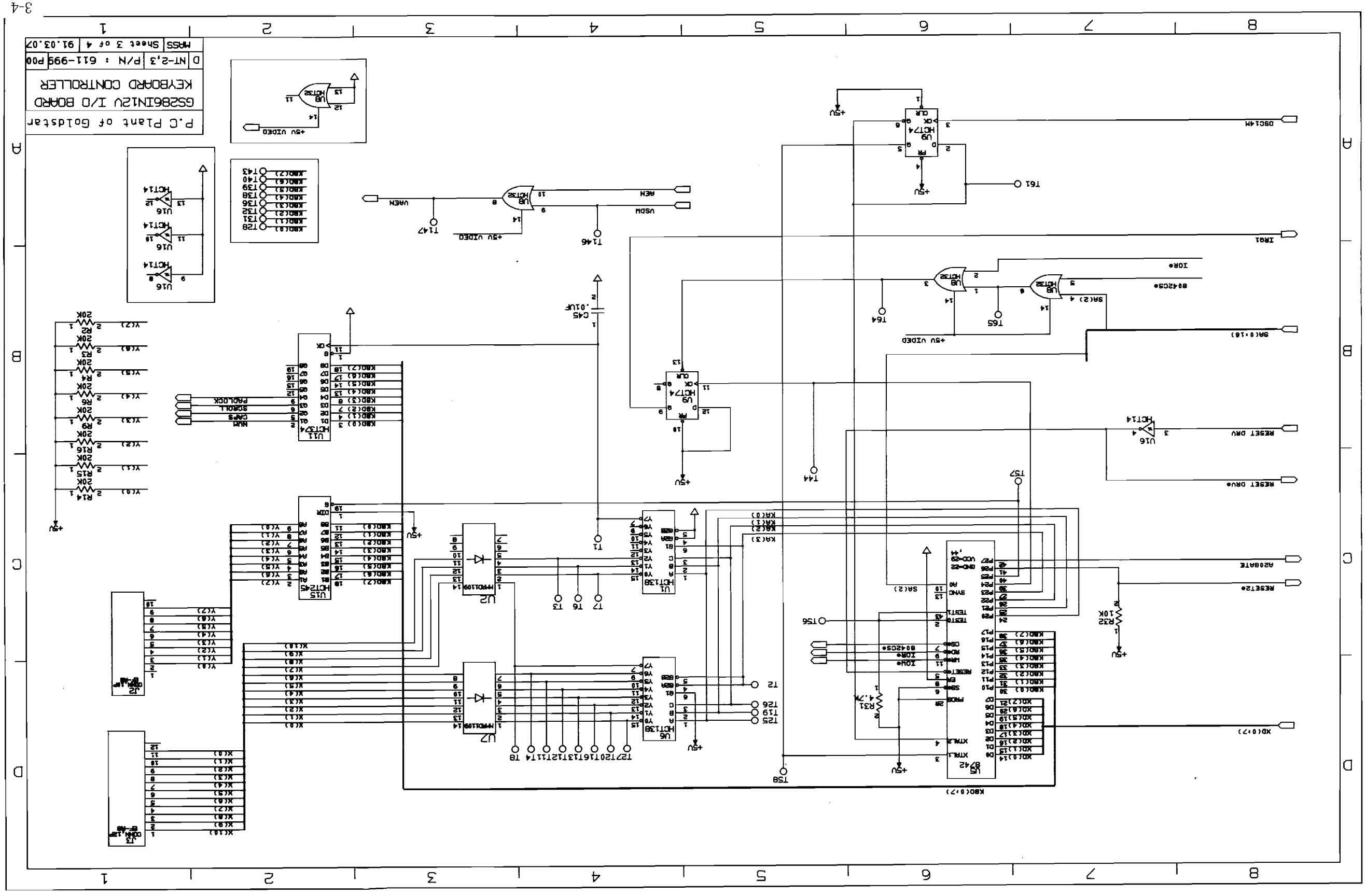
M/P | Sheet 1 of 7 | 91.03.27

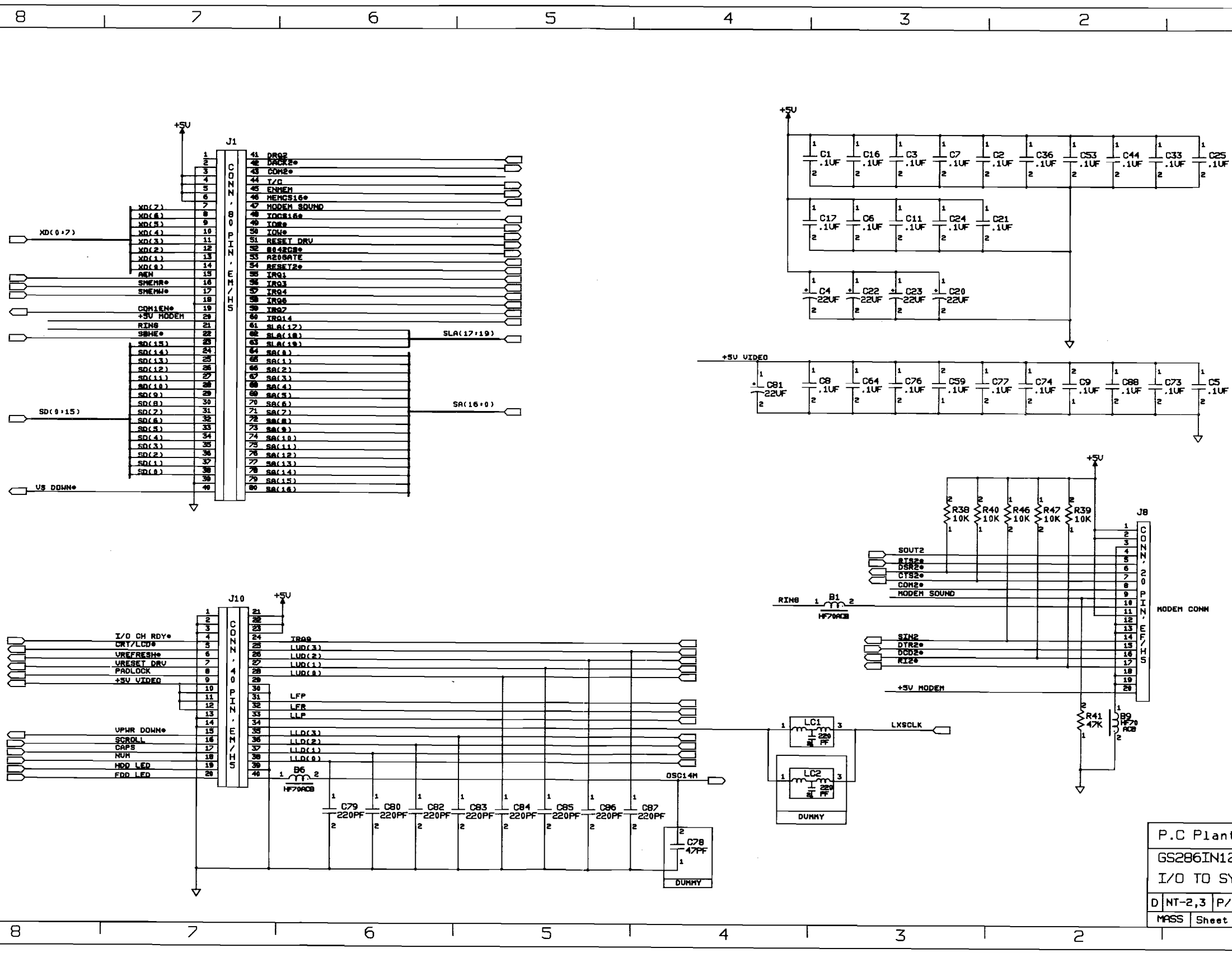

U13
82C343
SYSTEM CONTROLLER
U3
82C344
ISA BUS CONTROLLER
P.C Plant of Goldstar
GS386IN20V SYSTEM B/D
CORE LOGIC
D NT-3 P/N:611-994 P01
M/P Sheet 2 of 7 91.04.27

P.C Plant of Goldstar

GS286IN12V I/O BOARD
KEYBOARD CONTROLLER

D	NT-2,3	P/N : 611-999	P00
	MASS	Sheet 3 of 4	91.03.07




J1
CONN.80PIN.EM/HS
XD(0:7)
SD(0:15)
SLA(17:19)
SA(16:0)
VS DOWN#
+5V
+5V VIDEO
J8
CONN.20PIN.EM/HS
MODEM CONN
SOUT2
DTR2#
DSR2#
CTS2#
COM2#
MODEM SOUND
SIN2
DTR2#
DCD2#
RI2#
+5V MODEM
RING
LXSCLK
J10
CONN.40PIN.EM/HS
I/O CH RDY#
CRT/LCD#
VREFRESH#
VRESET DRV
PADLOCK
+5V VIDEO
VPWR DOWN#
SCROLL
CAPS
NUM
HDD LED
FDD LED
OSC14M
DUMMY
DUMMY
P.C Plant of Goldstar
GS286IN12V I/O BOARD
I/O TO SYS CONNECTOR
DRAWING NO : 611-999 P00
MASS
Sheet 4 of 4
91.03.07

P.C Plant of Goldstar

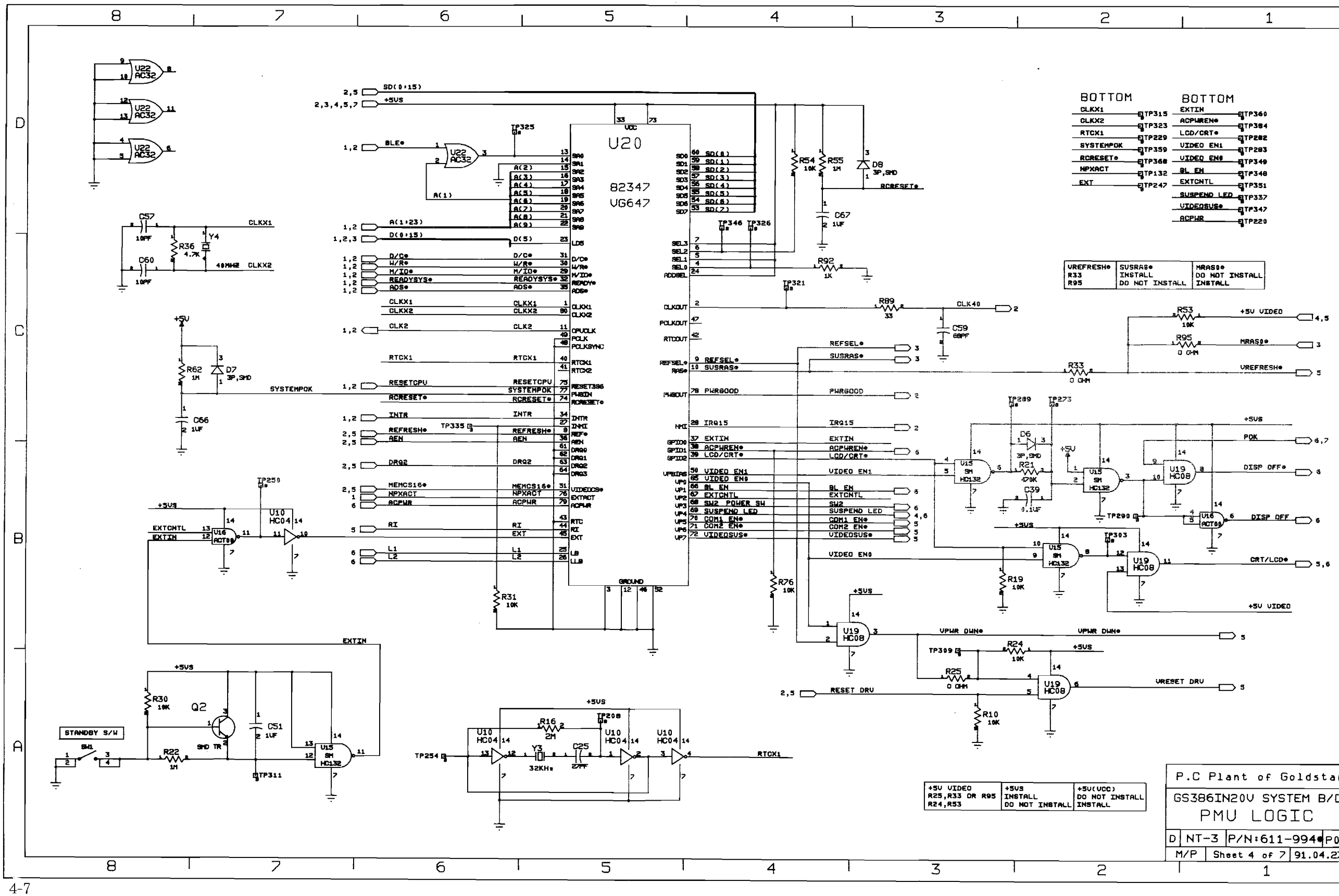
GS386IN20U SYSTEM B/D
MEMORY & EPROM

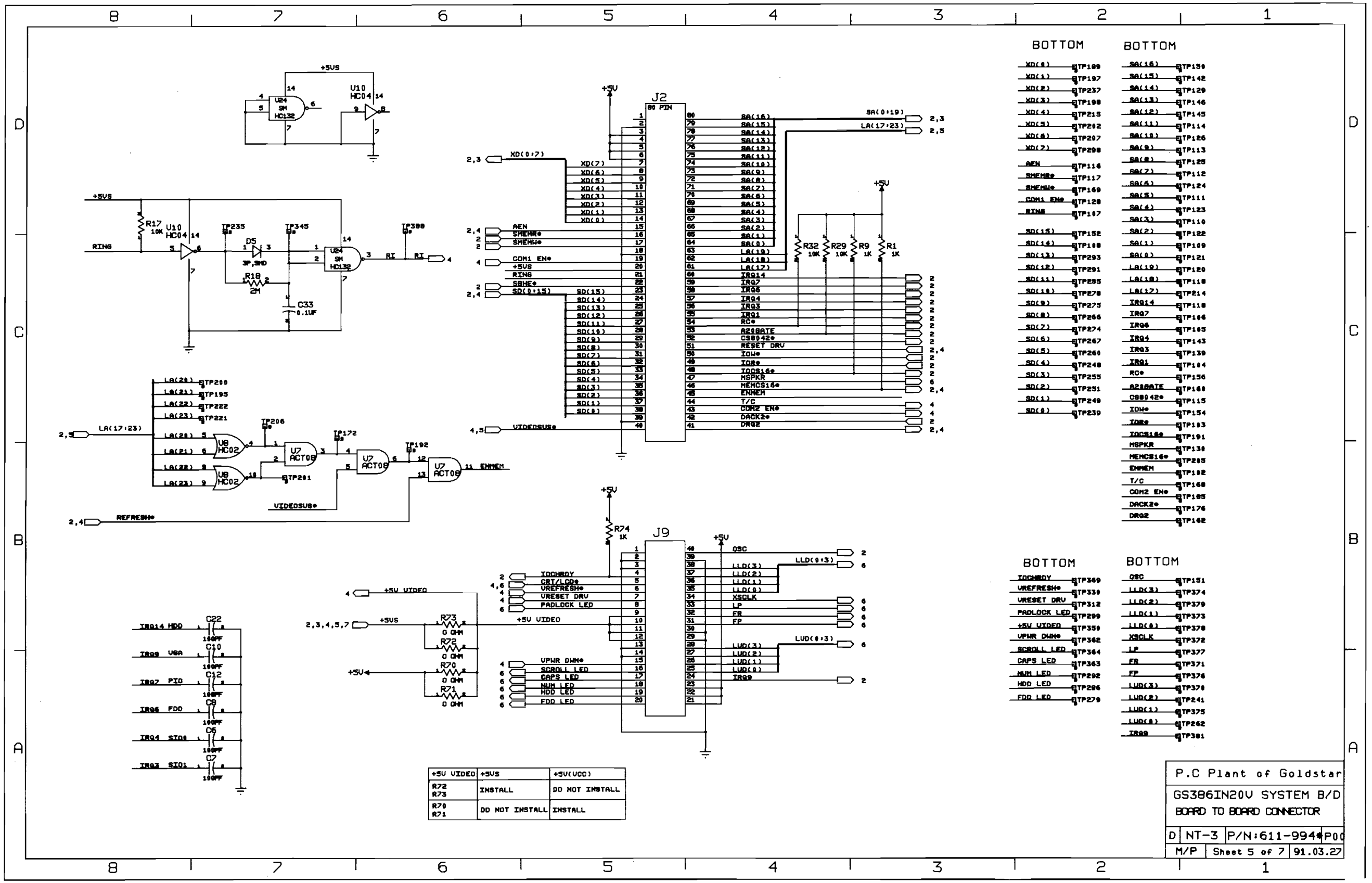
D	NT-3	P/N:6111-9944P03
M/P	Sheet 3 of 7	91.04.27

TOP BOTTOM

SUSRAS#
MCAS0#
MCAS1#
MRAS0#
REFSEL#
NORMAL#

SA(0:19)
XD(0:7)
MA(0:10)
D(0:15)
MOE#
MWE#
MCAS2#
MCAS3#
MRAS1#
+5US
2,3,4,5,7
3,4
4,5
2,5


U20
82347
VG647
BOTTOM
BOTTOM
CLKX1 TP315
CLKX2 TP323
RTCX1 TP229
SYSTEMPOK TP359
RCRESET* TP368
NPXACT TP132
EXT TP247
EXTIM TP360
ACPWREN* TP384
LCD/CRT* TP282
VIDEO EN1 TP283
VIDEO EN0 TP349
BL EN TP348
EXTCNTL TP351
SUSPEND LED TP337
VIDEOSUS* TP347
ACPWR TP220
VREFRESH* R33 INSTALL R95 DO NOT INSTALL
SUSRAS* INSTALL DO NOT INSTALL
MRAS0* DO NOT INSTALL INSTALL
+5V VIDEO R25,R33 OR R95 R24,R53
+5VS INSTALL DO NOT INSTALL
+5V(VCC) DO NOT INSTALL INSTALL
P.C Plant of Goldstar
GS386IN20V SYSTEM B/D
PMU LOGIC
D NT-3 P/N:611-994* P01
M/P Sheet 4 of 7 91.04.27



+5V VIDEO	+5VS	+5V(VCC)
R72 R73	INSTALL	DO NOT INSTALL
R70 R71	DO NOT INSTALL	INSTALL

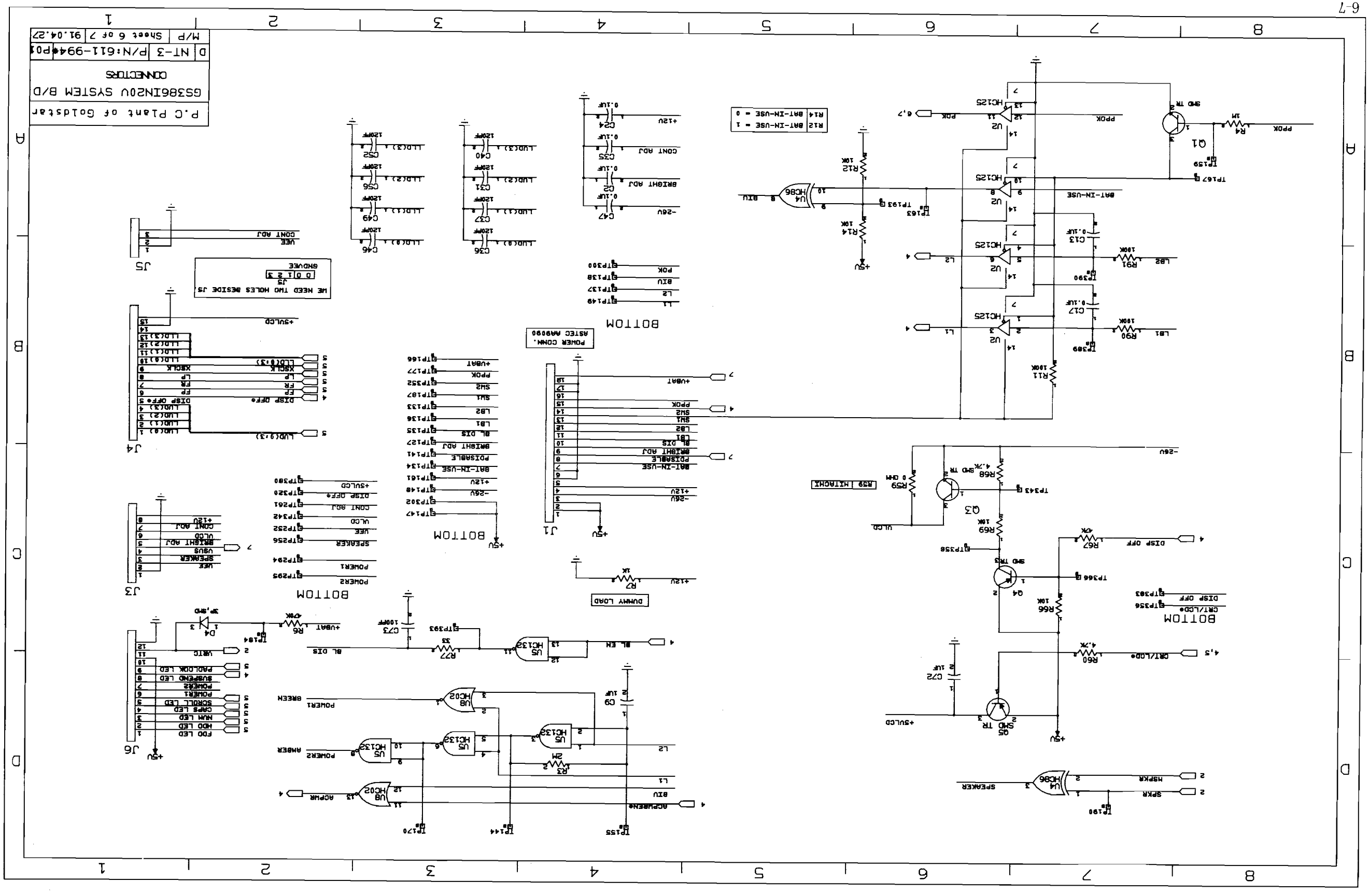
P.C Plant of Goldstar			
GS386IN20V SYSTEM B/D BOARD TO BOARD CONNECTOR			
D	NT-3	P/N:611-9944	P00
M/P	Sheet 5 of 7	91.03.27	

P.C Plant of Goldstar

GS386IN20U SYSTEM B/D

CONNECTORS

D	NT-3	P/N:611-9944P03
M/P	Sheet 6 of 7	91.04.27



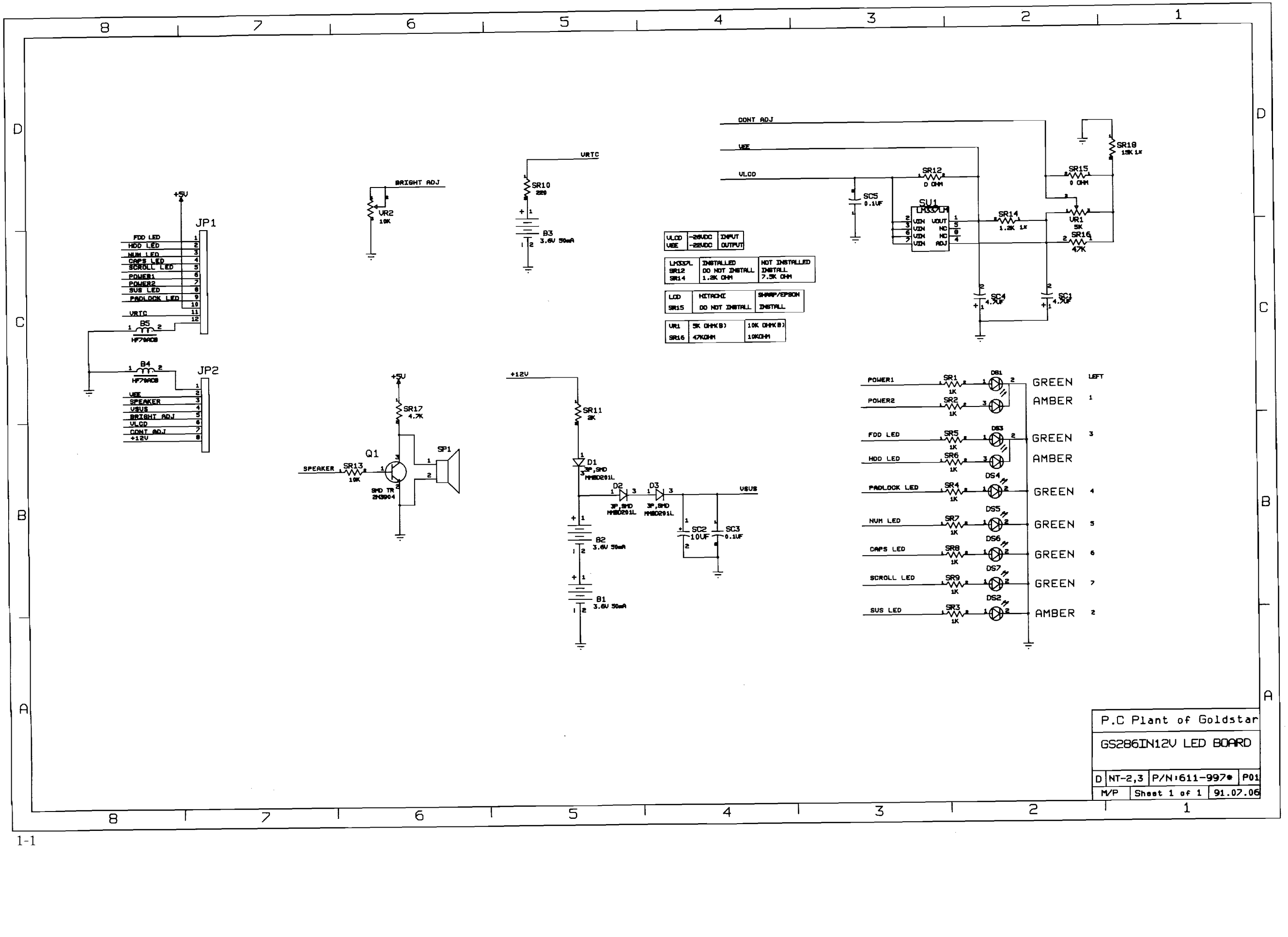
P.C Plant of Goldstar			
GS386IN20U SYSTEM B/D MICRO POWER REGULATOR			
D	NT-3	P/N:611-9944	P01
M/P	Sheet 7 of 7	91.04.27	

SPARE PARTS

U25 HC02 ×4
R93 1M
Q6 2N3906
TP3

C32 22UF
C71 22UF
C70 22UF
C68 22UF
C11 22UF
C29 22UF
C20 22UF
C1 22UF
C54 0.1UF
C48 0.1UF
C58 0.1UF
C62 0.1UF
C45 0.1UF
C55 0.1UF
C44 0.1UF
C30 0.1UF
C26 0.1UF
C42 0.1UF
C64 0.1UF
C61 0.1UF
C43 0.1UF
C16 0.1UF
C5 0.1UF
C18 0.1UF
C23 0.1UF
C53 0.1UF
C34 0.1UF
C21 0.1UF
C41 0.1UF
C28 0.1UF
C4 0.1UF
C50 0.1UF
+5US

C63 22UF
C65 0.1UF
R63 88K 1%
R64 1M 1%
R65 1M 1%
TP392
TP391
TP361
D1 FERRO 320
+5U
TP367
U21 LTL1020CS
GND NC NC SHUT FB -IN +IN NC VOUT VIN OVLO OVCP REF
C74 10UF
TP397
TP398
SW2
SW2 POWER S/W
1-2 POWER OFF
2-3 POWER ON
+UBAT D3 3A,SMD FUSE
6,7
VBUS
6
P5V
6,7
TP395
TP394
R94 10K
C75 .1UF
R75 4.7K
U24 HC132
U24 HC132
PDISABLE
6
TP396
+5US
2,3,4,5,7
+5US


JP1
FDD LED
HDD LED
NUM LED
CAPS LED
SCROLL LED
POWER1
POWER2
SUS LED
PADLOCK LED
VRTC
+5V
B5
HF70ACB
JP2
VEE
SPEAKER
VSUS
BRIGHT ADJ
VLCD
CONT ADJ
+12V
B4
HF70ACB
BRIGHT ADJ
VR2
10K
VRTC
SR10
220
B3
3.6V 50mA
CONT ADJ
VEE
VLCD
SC5
0.1UF
SU1
LM335CM
VIN
VOUT
ADJ
NC
SR12
0 OHM
SR14
1.2K 1%
SR15
0 OHM
SR10
15K 1%
VR1
5K
SR16
47K
SC4
4.7UF
SC1
4.7UF
VLCD -20VDC INPUT
VEE -22VDC OUTPUT
LM335FL INSTALLED NOT INSTALLED
SR12 DO NOT INSTALL INSTALL
SR14 1.2K OHM 7.5K OHM
LCD HITACHI SHARP/EPSON
SR15 DO NOT INSTALL INSTALL
VR1 5K OHM(B) 10K OHM(B)
SR16 47KOHM 10KOHM
+5V
SR17
4.7K
SPEAKER
SR13
10K
Q1
SMD TR
2N3904
SP1
+12V
SR11
2K
D1
3P,SMD
MMBD201L
D2
3P,SMD
MMBD201L
D3
3P,SMD
MMBD201L
VSUS
SC2
10UF
SC3
0.1UF
B2
3.6V 50mA
B1
3.6V 50mA
POWER1
POWER2
FDD LED
HDD LED
PADLOCK LED
NUM LED
CAPS LED
SCROLL LED
SUS LED
SR1
SR2
SR5
SR6
SR4
SR7
SR8
SR9
SR3
1K
DB1
DB3
DS4
DS5
DS6
DS7
DS2
GREEN
AMBER
GREEN
AMBER
GREEN
GREEN
GREEN
GREEN
AMBER
LEFT
1
3
4
5
6
7
2
P.C Plant of Goldstar
GS286IN12V LED BOARD
D NT-2,3 P/N:611-997* P01
M/P Sheet 1 of 1 91.07.06
1-1